NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 5 March 15, 1958

GENERAL

3473 AERE-Lib/L1(2nd Ed.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOURCES OF INFORMATION IN ATOMIC ENERGY. L. J. Anthony. July 31, 1957. 28p.

Sources of information on research and development in the field of atomic energy are listed. The availability of British, American, and Canadian reports and abstracts of articles on atomic energy and allied subjects appearing in scientific and technical journals is discussed. Sources of Russian information are reviewed. Atomic energy projects in other countries which may provide information are included. A list of published sources of information on atomic energy is appended. (C.H.)

Atomic Power

3474 AERE-CE/M-207
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ECONOMIC POSSIBILITIES OF ENERGY STORAGE ASSOCIATED WITH NUCLEAR ENERGY. K. M. Towers. Sept. 1957. 12p.

Methods of storing the energy produced by nuclear reactors are studied. It is concluded that only pumped water storage is likely to be economically worth while and this has the disadvantage of requiring specially suitable terrain. With improvements in design fuel cells may become attractive for special applications if sources of hydrogen and oxygen become available which are much cheaper than can be obtained from electrolysis. Chemical methods of energy storage offer the greatest scope for further developments, the exploration of methods of hydrogen production being considered most worth further study. This gas can be stored and is valuable as a chemical or as a source of gaseous or liquid fuels. (auth)

3475 ASAE-18
American Radiator and Standard Sanitary Corp. Atomic Energy Div., Redwood City, Calif.
SHIP DESIGN TREND SURVEY FOR THE ATOMIC ENERGY COMMISSION MARITIME REACTORS BRANCH. David L. Conklin, Jack J. Gordon, and S. Reed Nixon. June 13, 1957. 24p. Contract AT(04-3)-109.

Representatives of various phases of the shipping industry were approached for their opinions on the application of nuclear power plants to merchant ships. Among the topics discussed are ship types and hull forms, ship capacity and performance, and some of the nuclear problems such as refueling and shielding. (D.E.B.)

3476 MND-1031
Martin Co., Baltimore.
THE FEASIBILITY OF PRODUCING POWER FROM RADIOISOTOPES. F. Hittman. [1957]. 12p. $3.30 (ph OTS); $2.40(mf OTS).

Presented before the American Nuclear Society, Annual Meeting, Pittsburgh, June 10-14, 1957.

3477 NAA-SR-Memo-679
North American Aviation, Inc., Downey, Calif.
COST TRENDS IN MEDIUM SIZE CENTRAL STATION POWER PLANTS. J. L. Balderston. [1957]. 19p. $3.30 (ph OTS); $2.40(mf OTS).

The trend in the "technical costs" of electrical power production of medium size (60 to 150 Mw) coal fueled central station steam power plants is analyzed in order to predict the direction of such costs over the next decade or so. The term "technical costs" is used here to denote costs adjusted to current wage levels. The conclusion reached from this analysis, which is but a first approximation to the solution of the problem, is that these costs are now approximately constant. However, since such costs for industry as a whole are declining, it also appears that the cost of electrical power produced from coal will be henceforth a larger fraction of the total costs of industrial products. (auth)

3478
ECONOMICS OF ATOMIC POWER DEVELOPMENT IN INDIA AND THE INDIAN ATOMIC ENERGY PROGRAMME. H. J. Bhabha. Nature 180, 1382-7(1957) Dec. 21.

BIOLOGY AND MEDICINE

3479 CRB-739
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A PLAN FOR THE STUDY OF FERTILITY OF RELATIVES OF CHILDREN SUFFERING FROM HEREDITARY AND OTHER DEFECTS. PART I. OUTLINE OF THE PLAN. PART II. DETAILS OF THE PROCEDURES. H. B. Newcombe, S. J. Axford, and A. P. James. Nov. 1957. 79p. (AECL-511).

It has been assumed that the load of serious hereditary defects in human populations is maintained largely by reason of new mutations which occur in each generation. Present estimates of the increase in the load, which would be expected from radiation-induced increases in mutation rate, are based on this belief. However, it is recognized that the assumption represents an over-simplification, and that it could lead to an error of unknown magnitude in the estimate of damage. An increased fertility in apparently

unaffected carriers of the genes for defects may well be a major factor in maintaining the incidence of the defects. If this is the case, it will be necessary to re-assess the estimates of genetic damage from radiation. Unfortunately, there is little or no direct evidence from human populations, as to which factor is predominant in maintaining the present load of defects. It is here proposed that the most effective method of obtaining concrete information on differentials of fertility is through the appropriate use of provincial or national statistics which are already routinely collected. The present report describes the techniques available for a fertility study within one Canadian province over a limited period of time. By these techniques, present records of marriages, births, ill-health and deaths (in punchcard form) can be arranged into family groups, so that the fertility of families in which the defects occur can be compared with that of families which are unselected for defects. It is believed that such techniques will eventually prove suitable for routine use in a national vital statistics system, and that they can open the way for an understanding of the genetics of human populations which cannot be obtained in any other manner. (auth)

Radiation Effects

3480 AD-123620
Baylor Univ., Houston, Tex. Coll. of Medicine and Jefferson Davis Hospital, Houston, Tex.
A STUDY OF THE EFFECTS OF TOTAL AND PARTIAL BODY RADIATION ON IRON METABOLISM AND HEMATOPOIESIS. Progress Report for Period September 1, 1956 to March 1, 1957. Vincent P. Collins. 16p. Contract DA-49-007-MD-428.

Data are presented on the white blood cell and platelet counts in patients exposed to partial-body radiation doses of 25-r and above and whole-body x radiation doses of 100 r and above. (C.H.)

3481 AD-127606
Syracuse Univ., N. Y. Food Research Labs.
THE CHEMICAL ENHANCEMENT OF BACTERIAL RADIO-SENSITIVITY IN THE RADIATION STERILIZATION OF FOODS. Report No. 5 (Annual) [for] October 19, 1955–August 31, 1956. A. W. Phillips. 100p. Project No. 7-84-01-002. Contract DA-19-129-qm-524.

Fluid milk was sterilized by heat-pasteurization in the presence of 0.2% by weight of ethylene oxide followed by irradiation with 16 to 70 kilorep. The taste of the product was found acceptable. The effects of various combinations of heat, ethylene oxide, chemical treatments, and irradiation on the sterility and taste of milk are discussed. (C.H.)

3482 AD-130177
American Meat Inst. Foundation, Chicago.
RADIATION SENSITIVITY OF MEAT SPOILAGE MICROORGANISMS. Report No. 5 (Final Report) [for] January 14, 1956–April 14, 1957. C. F. Niven, Jr. 20p. Project No. 7-84-01-002. Contract DA-19-129-qm-574.

A study was made on the radiosensitivity of the microorganisms that limit shelf life of cured meat products. Data are tabulated on the identity, radiation resistance, and factors affecting radiation resistance of organisms responsible for the spoilage of fresh beef and pork, and the production of slimes on the surface of frankfurters during refrigerated storage. (C.H.)

3483 AF-SAM-57-33 (Rpt: UNCLASSIFIED)
Utah. Univ., Salt Lake City. Coll. of Medicine.
EFFECT OF PRE-RADIATION IMMUNIZATION ON RESISTANCE TO AEROSOL-INDUCED INFECTION IN X-IRRADIATED MICE. Eugene H. Perkins and Stanley Marcus. Aug. 13, 1956. 7p. (AD-132262).

The effect of active immunization prior to x radiation (acute and chronic whole-body exposure) was determined in mice infected with an aerosol of Klebsiella pneumoniae. Adult mice were immunized by multiple injections and irradiated seven days following the final injection. Control and immunized animals were then challenged four and six days following radiation exposure. Immunization prior to x radiation increased resistance to infection. This protective effect was not destroyed at sublethal to near mid-lethal levels of x radiation exposure. A large total dose, given in increments, was found to be far less detrimental to the host defenses than the same dose acutely administered. (auth)

3484 AF-SAM-57-74
School of Aviation Medicine, Randolph AFB, Texas and Oak Ridge National Lab., Tenn.
BIPHASIC HYPERFERREMIA INDUCED IN RATS BY X-IRRADIATION. G. S. Melville, Jr. and F. P. Conte. Nov. 27, 1956. 4p. (AD-132264).

The hyperferremia that developed in rats after a single dose of 75 to 225 r of total-body x irradiation occurred in two distinct phases. A transient rise in plasma iron occurred within the first twenty-four hours after irradiation, and a more prolonged elevation took place during the second week after exposure. The concentration of plasma iron in normal rats varied from day to day and in relation to the hour of sampling. (auth)

3485 AF-SAM-57-154
School of Aviation Medicine, Randolph AFB, Texas and Tennessee. Agricultural Experiment Station, Oak Ridge.
EFFECT OF ACUTE TOTAL-BODY GAMMA IRRADIATION ON PLASMA IRON AND IRON UPTAKE IN THE BURRO AND THE SHEEP. George S. Melville, Jr. and Bernard F. Trum. June 27, 1957. 7p.

Groups of burros and sheep were exposed to the gamma radiations from zirconium^{95}-niobium^{95} sources. Iron uptake in the red blood cells was depressed at all dose levels in both species, the maximum mean depression for all animals being 30%. A definite plasma hyperferremia was found in all the animals at all doses given. The response is of a double maximal nature: the first maximum occurred within 24 hr postexposure; the second, at approximately 1 week. (auth)

3486 UCRL-8031
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1957. Oct. 14, 1957. 19p. Contract W-7405-eng-48. $0.75(OTS).

Data are presented from studies on Sr^{90} metabolism in monkeys and the deposition of Ce^{144} in the developing fetal skeleton in rats. Progress is reported in the study of radiation-induced reactions of proteins in aqueous solution. The process of thermal-neutron-induced activation of indium foils was adapted to the measurement of fast neutrons. A radiation survey was made at the 184-inch cyclotron and recommendations were made regarding additional shielding. Routine health chemistry and health physics activities during the period are summarized. (For preceding period see UCRL-3880.) (C.H.)

3487
ON EXPERIMENTAL TUMOR PRODUCTION IN IRRADIATED TISSUE. Reinhard Schober and Oleg Erdely. Acta Radiol. 48, 307-18(1957) Oct.

A subcutaneous injection of an oily suspension of methyl

cholanthrene in rats caused fibroblastic sarcomas to develop after about 20 weeks. When the injections were performed in animals which had previously received whole body radiation or been subjected to more or less large doses of local irradiation at the injection site, it was found that the lesion developed more rapidly; furthermore, no reduction in the latent period (interval between the time of injection and first appearance of the tumor) occurred and no tumor developed after a local pre-irradiation dose of 4,000 r. The possible ways in which the changes might have been effected by the radiation are discussed. (auth)

3488

DEPOSITION OF IRON IN NORMAL AND IRRADIATED LIVER OF FOETAL MOUSE. Habibollah Izadian and Jean-Francois Duplan. Compt. rend. 245, 1756-8(1957) Nov. 13. (In French)

3489

BLASTOMATOGENIC EFFECTS OF RADIOACTIVE STRONTIUM (Sr^{90}). N. A. Kraevskii and N. N. Litvinov. Med. Radiol. 2, No. 5, 33-9(1957) Sept.-Oct. (In Russian)

The optimal blastomatogenic doses of Sr^{90} were determined for the majority of animals. The latent period of tumor development is in reverse proportion to the instituted dose and varies in different species. The period of development of bone tumors, their localization, and number depend not only on the dose but, also, on the condition of the organism at the moment of administration of the isotope and on the age of the animal. Primary multiple development of bone tumors, reticulous or hemocytoblastic-type leukemias as well as leukemias with signs of tumor growth, are characteristic effects caused by strontium. (R.V.J.)

3490

RADIOACTIVE ISOTOPES AS CANCEROGENIC AGENTS. V. N. Strel'tsova and Yu. I. Moskalev. Med. Radiol. 2, No. 5, 39-51(1957) Sept.-Oct. (In Russian)

A comparative analysis is presented of the cancerogenic effects of 15 radioactive isotopes (Sr^{89}, Sr^{90}, mixture of Sr^{89} and Sr^{90}, Ba^{140}, Y^{90}, Y^{91}, mixture of β emitters, Cs^{137}, Ca^{45}, Nb^{95}, Ce^{144}, Pm^{147}, La^{140}, Ru^{106}, and Pu^{239}) which differ in their physical properties and distribution in the organism. The incidence of osteosarcomas depends on the quantity of the radioactive substance introduced and on the period of actual fission, the higher the effective fission period the higher is the percentage of tumor development. The optimal osteosarcomagenic dose of absorbed energy is 10 to 20 krep, the minimum dose 2 to 3 krep. The incidence of leukemias induced by radioactive isotopes ranges from 3 to 10%. The type of tumors, the location, and development processes depend on the character of distribution of the radioactive substances. (R.V.J.)

3491

INVESTIGATIONS OF IONIZING RADIATION EFFECTS ON INFECTION AND IMMUNITY. P. N. Kiselev (Central Research Roentgen-Radiological Inst., Ministry of Health, U.S.S.R.). Med. Radiol. 2, 55-64(1957) Sept.-Oct. (In Russian)

3492

EFFECT OF NITRIC OXIDE ON THE RADIOSENSITIVITY OF BACTERIA. P. Howard-Flanders (Univ. of California, Berkeley). Nature 180, 1191-2(1957) Nov. 30.

3493

INTESTINAL DAMAGE BY RADIATION AND ITS CHEMICAL MODIFICATION. R. H. Mole and Diana M. Temple (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Nature 180, 1276(1957) Dec. 7.

3494

CHROMATOGRAPHIC CHARACTERIZATION OF SOLUBLE DEOXYPOLYNUCLEOTIDES RELEASED IN MOUSE SPLEEN BY X-IRRADIATION. R. K. Main, L. J. Cole, and M. E. Ellis (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Nature 180, 1285-6(1957) Dec. 7.

3495

ROLE OF STRUCTURAL DEGRADATION IN THE LOSS OF SEROLOGICAL ACTIVITY OF OVALBUMIN IRRADIATED WITH GAMMA-RAYS. Hugo Fricke, Charles A. Leone, and Wendell Landmann (Argonne National Lab., Lemont, Ill.). Nature 180, 1423-5(1957) Dec. 21.

3496

INCREASED PROTHROMBIN CONSUMPTION FOLLOWING TOTAL BODY X-IRRADIATION IN MAN. Niel Wald (USAF School of Aviation Medicine, Randolph AFB, Texas). Proc. Soc. Exptl. Biol. Med. 96, 294-7(1957) Nov.

Hematological studies were carried out on 41 patients with disseminated neoplastic disease receiving therapeutic whole-body x irradiation. Increased prothrombin consumption, evidenced by an increase in the average serum prothrombin time, and in the incidence of prolonged serum prothrombin times, was found after irradiation. Greater sensitivity resulted when pure fibrinogen was used in place of prothrombin-free plasma in the one-stage serum prothrombin time test. Possible explanations for these findings were discussed. (auth)

3497

THRESHOLDS FOR PAIN AND CONVULSIONS IN THE GUINEA PIG FOLLOWING MASSIVE WHOLE-BODY IRRADIATION. Howard L. Andrews (Department of Health, Education and Welfare, Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 96, 345-8(1957) Nov.

3498

THYMUS SPECIFICITY IN LETHALLY IRRADIATED MICE TREATED WITH RAT BONE MARROW. N. Gengozian, I. S. Urso, C. C. Congdon, A. D. Conger, and T. Makinodan (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 96, 714-20(1957) Dec.

3499

AMINO ACIDURIA IN PRIMATES FOLLOWING IRRADIATION. C. G. Hunter (Univ. of Toronto). Proc. Soc. Exptl. Biol. Med. 96, 794-6(1957) Dec.

The daily urine amino N excretion of 4 monkeys was followed before and after whole body irradiation with doses in the lower lethal range. In 2 non-survivors, there was little change in the daily quantity excreted until terminally. In 2 survivors given the same food intakes as in the irradiated study and sham irradiated, the daily urine amino N excretion during the first week differed but slightly from the values after irradiation, but in the second week more amino N was excreted after irradiation in one animal and less in the other. It would appear that amino aciduria in primates irradiated with doses in the lower lethal range is inseparable from the natural response of the over-all protein metabolism associated with any injury. (auth)

3500

FURTHER STUDIES ON DIURESIS IN NORMAL AND ADRENALECTOMIZED RATS FOLLOWING TOTAL-BODY X-IRRADIATION. E. Irene Pentz (Argonne Cancer Research Hospital and Univ. of Chicago, Ill.). Proc. Soc. Exptl. Biol. Med. 96, 829-33(1957) Dec.

3501

ON THE EFFECT OF SMALL DOSE X RADIATION ON SEPTICEMIA CAUSED BY PNEUMONIAE FRIEDLANDER. PART II. THE EFFECT OF SMALL TOTAL DOSE X RADIATION ON A SUBCUTANEOUS INFECTION. Rudolf Birkner, Roelf-Diedrich Meyer, and Johannes Trautmann. Strahlentherapie 103, 552-8(1957). (In German)

The effect of small doses of whole-body x radiation on the septicemia caused by Klebsiella pneumoniae

Friedlinder in white mice depends on the moment of the irradiation, the dose, the temporal dose distribution, the age and the sex of the animals, as well as on the quantity of germs applied. Animals die more rapidly if irradiations have been applied previous to the infection, while irradiations after infections lead to longer life. (auth)

3502

INVESTIGATION OF THE EFFECT OF X-RADIATION ON THE CARBOHYDRATE METABOLISM OF TUMOR CELLS. Heinrich Maass and Gunther Heinz Rathgen. Strahlentherapie 103, 668-94(1957). (In German)

After irradiating some inoculation tumors of the rat and of a human carcinoma with doses of from 10 to 25 kr, an unequivocal depression of the respiration and particularly of the aerobic and anaerobic glycolysis could be observed. The carbohydrate metabolism of the rat liver remained uninfluenced. By determination of some metabolite concentrations, the mechanism of the ray-induced inhibition of the glycolysis could be elucidated to a great extent. Accordingly it is probable that the point of attack of the ray effect must be searched for within the glycolysis chain at the step of the dehydrogenation of the triosephosphate. (auth)

3503

COMPARISON OF PRIMARY EFFECTS OF RADIOMIMETRIC SUBSTANCES AND IONIZING RADIATION. Rolf Demmler. Strahlentherapie 103, 695-713(1957). (In German)

3504

THE EFFECT OF X RAY EXPOSURE ON THE NUCLEAR SYSTEM OF A WALKERS CARCINOMA CELL. Heinz Karl Parchwitz and Erika Parchwitz. Strahlentherapie 104, 6-20(1957). (In German)

By means of karyometric methods and cytological observations the authors have examined the change of form of the nuclear system after a single x-ray irradiation of 8000 r. They observed a change of the nuclear contents and a change of form of the nucleole. These reactions, which have to be considered as a consequence of the ray insults, may be divided into two phases. The first phase has to be explained as a morphological expression of an increased function, the second phase must be regarded as a morphological equivalent to the prelethal state of the cells. A discussion of the results is included. (auth)

3505

MORPHOLOGICAL INVESTIGATION OF EXTRANUCLEAR CELL CONSTITUENTS OF WALKERS CARCINOMA CELL AFTER SINGLE IRRADIATION. Heinz Karl Parchwitz. Strahlentherapie 104, 21-8(1957). (In German)

Changes are described in the form and disposition of the mitochondria of Walker's carcinoma-cell after local single irradiation with x rays of 8000 r. The alterations of these extranuclear cell constituents are ascribed to the morphological changes in the nuclear system. The course of the reaction towards irradiation may be subdivided into two phases. The author discusses the functional states on which the observations are based. (auth)

Radiation Hazards and Protection

Refer also to abstract 3797.

3506 NARF-57-51T (Rpt: UNCLASSIFIED)

Convair, Fort Worth, Tex.

ENVIRONMENTAL RADIOACTIVITY IN THE NTA TEST AREA AND FLIGHT CORRIDOR. R. F. Shockley and W. R. Miller. Nov. 25, 1957. 81p. Project 6(1-9964). Contract AF33(600)-32054. (3-R-72R(Rev. C)).

Baseline levels of radioactive content of air, soil, water, and vegetation were established prior to both the 1955 Nevada weapons tests and the first flight of the Nuclear Test Airplane. Subsequent samples were taken and the activity levels were compared with the baseline levels. As expected, the radioactive content of the samples increased as a result of nuclear detonations. Between series of weapons tests the levels, in general, returned to the values established prior to the 1955 series. Since early summer of 1956 however, the levels have consistently remained above the baseline values. Analysis of the data and a study of the operational history of the Nuclear Test Airplane led to the conclusion that there was no change in the environmental radioactivity attributable to operation of the Nuclear Test Airplane. (auth)

3507 USNRDL-TR-120

Naval Radiological Defense Lab., San Francisco.

SUGGESTED TECHNIQUES FOR TESTING THE EFFECTIVENESS OF RADIOLOGICAL RECLAMATION METHODS. E. Shapiro and E. T. Sheffield. Nov. 23, 1956. 22p. Project NY-320-001-7.

After a contaminating nuclear attack, operational recovery of essential facilities will probably require the use of reclamation methods. Before carrying out large-scale reclamation operations, it is necessary to make effectiveness tests on small areas of the methods selected in the pre-attack recovery plan to see whether the methods will achieve the predicted effectiveness. For determining the effectiveness of reclamation methods, the following testing techniques are suggested: vertical measurement, horizontal measurement, computation, shielded instrument, and removable test area. The first three techniques appear to be most feasible operationally. If field experiments indicate reliability of these three techniques, they should be preferred to the other two techniques which require additional effort. In situations where a shielded instrument is available, maximum reliability would be achieved by using this instrument with the vertical or horizontal technique or, better, a combination of both. (auth)

3508 USNRDL-TR-184

Naval Radiological Defense Lab., San Francisco.

ALTERATION OF BETA RADIATION LESIONS OF THE SKIN BY CYSTEINE, NITRITE, HYPOXIA, SPLEEN HOMOGENATE, AND BONE MARROW HOMOGENATE. A. K. Davis, D. Cranmore, and E. L. Alpen. Aug. 15, 1957. 17p. Project NM-006-015.

The purpose of this investigation was to evaluate some of the more common agents which are known to reduce the lethal effects of whole-body ionizing radiation in terms of their specific action on radiation damage to skin. Hypoxia, cysteine, and nitrite were administered before or during radiation; and spleen and bone marrow homogenates were studied for their action when administered after irradiation. Rats were exposed to a dose of beta radiation which produced ulceration in all untreated rats (ED_{100}), and graded daily by the gross appearance of the irradiated area. The most effective protection was obtained by exposure of the rat to a 95 percent nitrogen–5 percent oxygen mixture during irradiation. Cysteine, 1.0 mg/gm body weight, as well as hypoxia prevented ulceration of the exposed area; nitrite was less effective. However, all the pretreatment procedures reduced the severity of the lesion. Injection of spleen or bone marrow homogenates had little effect on the damage to the irradiated area. None of the procedures prevented the occurrence of erythema or epilation in the exposed area. It would appear that beta radiation injury to skin could serve as a useful measure of

radiation protection only when this protection is of a general nature. If the action is one involving a critical tissue, i.e., hematopoietic, skin injury is unlikely to provide an adequate estimate of the potential radiation protection that could be obtained. (auth)

3509 WADC-TR-57-142 (Rpt: UNCLASSIFIED) Wright Air Development Center. Aero Medical Lab., Wright-Patterson AFB, Ohio.

HEALTH-PHYSICS PROCEDURES FOR AN AEROMEDICAL RADIOISOTOPES LABORATORY. Thomas J. McGuire. Mar. 29, 1957. 34p. Project title: HIGH ALTITUDE PHYSIOLOGY. Task Title: PHYSIOLOGICAL MEASUREMENTS AND SERVICES. (AD-118113).

Radioisotopes will be utilized in tracer work involving studies on the effect of simulated altitude on laboratory animals. Iodine^{131}, Na^{24}, and Cr^{51} are the isotopes to be handled. Recommendations are presented which are applicable to the installations setup, equipment selection, health monitoring, isotopes handling, personnel protection, waste disposal, and decontamination. (auth)

3510

AN ESTIMATE OF THE GENETIC DOSE FROM RADIOTHERAPY. P. R. Purser and C. F. Qvist (Radium Center, Copenhagen, Denmark). Acta Radiol. 48, 267-72(1957) Oct.

The roentgen-equivalent-genetic dose (reg) from radiotherapy was calculated to be 1 m reg per head of population. This figure is based on data from a survey of a population of 959,000 in Denmark and sample measurements of gonad doses. (C.H.)

3511

GONAD DOSES RECEIVED DURING THE MEDICAL APPLICATION OF ROENTGEN RADIATION. Kristian Koren and Sem Maudal. Acta Radiol. 48, 273-9(1957) Oct.

The gonad doses received by male and female patients during the medical application of roentgen rays have been measured systematically on a dummy. Their relationships to the skin and volume doses are shown. (auth)

3512

THE SHORTENING OF LIFE BY CHRONIC WHOLE-BODY IRRADIATION. G. Failla and Patricia McClement. Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 946-54(1957) Dec.

A statistical analysis was made of data on the effect of chronic irradiation on life span. Data on radiation injuries in mice were analyzed in terms of the Gompertz function in such a way that the resulting curves are internally consistent. Findings were extrapolated to man using available data. The present permissible limit for accumulated radiation dose for those occupationally exposed is 210 r at age 60. On the basis of the assumptions presented, life shortening of about 8 months is to be expected following chronic exposure to 0.05 r per day. If 500 r is assumed to be the average dose accumulated up to age 60, the life-shortening is estimated at 1.5 years. (C.H.)

3513

THE GENETIC BASIS FOR THE LIMITATION OF RADIATION EXPOSURE. Bentley Glass (Johns Hopkins Univ., Baltimore, Md.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 955-60(1957) Dec.

The chemical nature of hereditary material, and factors involved in the transmittance of genetic information are reviewed. The relationship between mutation frequency and man-made doses of ionizing radiation is discussed. It is pointed out that radiation acts blindly, not selectively on certain genes and not on others. The deleterious nature of the vast majority of mutations is discussed. (C.H.)

3514

BONE, SKIN, AND GONADAL DOSES IN ROUTINE DIAGNOSTIC PROCEDURES. J. S. Laughlin (Sloan-Kettering Inst. and Memorial Center, New York); I. Pullman (Sloan-Kettering Inst., New York); and M. L. Meurk and R. S. Sherman (Memorial Center, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 961-82(1957) Dec.

Methods for measuring radiation dose, the amount of radiation received naturally, and data on the radiation dose incident to diagnostic radiological procedures are discussed. (C.H.)

3515

PRACTICAL SUGGESTIONS FOR REDUCING RADIATION EXPOSURE IN DIAGNOSTIC EXAMINATIONS. Lauriston S. Taylor (National Bureau of Standards, Washington). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 983-7 (1957) Dec.

3516

PAST AND PRESENT RADIATION EXPOSURE TO RADIOLOGISTS FROM THE POINT OF VIEW OF LIFE EXPECTANCY. Carl B. Braestrup (Francis Delafield Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 988-92(1957) Dec.

3517

COMMON SENSE IN RADIATION PROTECTION APPLIED TO CLINICAL PRACTICE. Robert S. Stone (Univ. of California School of Medicine, San Francisco). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 993-9 (1957) Dec.

3518

A SUMMARY: TODAY'S PROBLEMS IN RADIATION HAZARDS AND WHAT IS BEING DONE TO CONTROL THEM. Richard H. Chamberlain (Univ. of Pennsylvania, Philadelphia). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 78, 1000-2(1957) Dec.

3519

RADIATION HAZARDS ASSOCIATED WITH USE OF THE STRONTIUM 90 BETA APPLICATOR. W. A. Gore, M. A. Greenfield, C. T. McGraw, J. R. McProuty, and M. Rowen (Veterans Administration Center and Univ. of California at Los Angeles, Calif.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 54-6(1958) Jan.

3520

DOSES OF RADIATION FROM NATURAL AND ARTIFICIAL RADIOACTIVE SOURCES. L. F. Franzen, G. Myszynski, and G. Wiesenack. Atomwirtsch. 2, 362-6 (1957) Nov. (In German)

Only since quite recently has man been subjected to irradiation which, as the result of medical and industrial development has been added to the radiation from natural sources. According to the investigations quoted artificial radiation accounts for 20 to 25% of the total radiation level. Atomic test explosions have so far only made an insignificant contribution. The same can still be said of the industrial application of nuclear energy which is still in its infancy. It has been estimated that people living in Europe will over a period of 30 years be subjected to a total dose of radiation from 2,500 to 4,000 mr. Of this total dose received in 30 years about 750 to 850 mr will be contributed by medical and industrial appurtenances, the overwhelming share of 600 to 700 mr being the result of medical x-ray diagnosis. The atmospheric radioactivity has been estimated (incl. rainfall etc.) at 20 to 30 mr over a period of 30 years and will therefore not represent any hazards as far as external, direct radiation is con-

cerned. The possible absorption by and accumulation of radiating substances in the body must, however, be carefully studied and special consideration must be given to fission products with a long half-life. Regarding the accumulation of certain substances in plants and animals it is still not possible to make a generally valid statement though a great number of facts have been collected. The present internationally agreed permissible dose rates are used as a criterion specially for the maximum permissible concentrations of radioisotopes, isotope mixtures, short-term absorption, catastrophies, and also include soil contamination. (tr-auth)

3521

ON THE CONSEQUENCES OF RADIOACTIVE Sr^{90} FALLOUT. A. V. Lebedinskii. Med. Radiol. 2, No. 5, 22-33 (1957) Sept.-Oct. (In Russian)

3522

EVALUATION OF Sr^{90} AS CONTAMINATING FACTOR. A. N. Marei. Med. Radiol. 2, No. 5, 89-95(1957) Sept.-Oct. (In Russian)

3523

BENEFICIAL EFFECT OF QUINOXALINE 1,4-di-N-OXIDE IN RADIATION INJURY IN MICE. Thomas J. Haley, Anna M. Flesher, R. Veomett, and J. Vincent (Univ. of California at Los Angeles). Proc. Soc. Exptl. Biol. Med. 96, 579-82 (1957) Dec.

It has been shown that premedication with Quinoxaline-1,4-di-N-oxide is beneficial to irradiated mice, significantly increasing both the ST_{50} day and total number of survivors. The effect has been related to a significant reduction in number of enteric organisms causing the usual irradiation bacteremia. It has been demonstrated that lactobacilli were the predominating invaders under conditions of our experiments. The drug does not appear to have an effect on bone marrow. (auth)

3524

MODIFICATION OF ANTIBODY RESPONSE IN X-IRRADIATED RATS BY INJECTION OF SPLEEN HOMOGENATES. Mariano F. La Via, Melba Robson, and Robert W. Wissler (Argonne Cancer Research Hospital and Univ. of Chicago, Ill.). Proc. Soc. Exptl. Biol. Med. 96, 667-70(1957) Dec.

Antibody formation, which is inhibited by 500 r of total body x-irradiation into the rat, can be restored partially by spleen homogenates injected soon after irradiation. No striking difference in the degree of recovery is observed when spleen cells from rats stimulated earlier with a different antigen are used in place of normal spleen cells. (auth)

3525

A FATAL REACTION CAUSED BY IMPLANTATION OF ADULT PARENTAL SPLEEN TISSUE IN IRRADIATED F_1 MICE. E. E. Schwartz, A. C. Upton, and C. C. Congdon (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 96, 797-800(1957) Dec.

Implantation into irradiated F_1 hybrids of viable spleen cells from non-irradiated adult mice of the parental strains caused death within 2 to 4 weeks. The fatal reaction occurred even after sublethal doses of radiation or when the recipients were also injected with marrow cells from isologous hybrids or from mice of the same strain as that from which the parent-strain spleen tissue was obtained. The deaths are ascribed to the formation by the implanted cells of antibodies against the recipient. (auth)

3526

HEMATOLOGICAL INVESTIGATION OF THE EFFECT OF PROTECTIVE MATERIAL. PART V. THE RADIATION REACTION OF SPLEEN AFTER THE USE OF PROTECTIVE MATERIAL. Helmut Hartweg. Strahlentherapie 103, 559-63(1957). (In German)

The author reports on investigations in which the influence of homologous bone marrow, cysteine and vitamin P on the x-ray reaction of the spleen was tested in rats. The effect of these substances on the spleen is not as plain as on the bone-marrow. Lead protection on a shank and preliminary treatment with vitamin P leads to a regeneration that sets in 48 hours earlier. All the protected animals show complete recovery of the spleen structure on the 45th day, the control animals on the 60th day only. (auth)

3527

THE RADIATION DOSES TO GONADS DURING DIAGNOSTIC AND THERAPEUTIC APPLICATION OF IONIZING RAYS. Hanns-Joachim Lossl. Strahlentherapie 103, 614-19(1957). (In German)

Radiation Sickness

3528

GENERAL PRINCIPLES IN THE TREATMENT OF LESIONS CAUSED BY RADIOACTIVE SUBSTANCES. V. A. Sanotskii. Med. Radiol. 2, No. 5, 14-22(1957) Sept.-Oct. (In Russian)

3529

CLINICAL PICTURE AND TREATMENT OF CHRONIC RADIATION SICKNESS. P. N. Kireev. Med. Radiol. 2, No. 5, 72-9(1957) Sept.-Oct. (In Russian)

Radiotherapy

3530

IRRADIATION OF CARCINOMA OF THE BLADDER BY A CENTRAL INTRACAVITARY RADIUM OR COBALT 60 SOURCE (THE WALTER REED TECHNIQUE). Milton Friedman (New York Univ. Coll. of Medicine and Hospital for Joint Diseases, New York) and Lloyd G. Lewis (Georgetown Univ. Coll. of Medicine, Washington). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 6-31(1958) Jan.

3531

SOME ASPECTS OF SUPERVOLTAGE RADIATION THERAPY. W. J. Meredith (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 57-63(1958) Jan.

3532

THE TREATMENT OF CHILDRENS' HEMANGIOMA AND NEVUS FLAMMEUS WITH Sr^{90} AND Y^{90}. Hanns-Joachim Lössl and Alfons Jakob. Strahlentherapie 104, 90-3(1957). (In German)

The authors report the excellent results obtained in the radiotherapy of the hemangioma of the child and of the nevus flammeus by means of strontium-90 and yttrium-90. The method is preferred to others as it reduces the charge of rays on the growing skeleton of the child and on the gonads. In case of smaller lesions the application of strontium-90 (total dose 3000 to 5000 rep) and surface irradiation by means of yttrium-90 foils (total dose 3000 to 4000 rep) produce good results. The single dose should be around 1000 rep. The dosage has to be fixed according to the erythema which appears with medium intensity. To judge from the gathered experiences the results of this therapy are equivalent to those of radium treatment or Chaoul's close irradiation. (auth)

3533

AN INSTRUMENT FOR APPLICATION OF RADIOACTIVE GOLD ALLOWING FOR PROTECTION AGAINST IRRADIATION. Gunther Vormum and Helmut Ernst. Strahlentherapie 104, 127-30(1957). (In German)

A description is given of an instrument for the therapeutic application of radiogold. It allows the application of more than 100 mc of radioactive solution within the tolerance limit for the irradiation load. The course of the infusion can be watched through an optic system. The interior parts of the apparatus can easily be sterilized. The radiogold can be loaded with the aid of a long distance pipetting instrument, so that sufficient protection against irradiation is provided at all stages of the work. The apparatus has proved its worth in clinical work. (auth)

Toxicology Studies

3534

THE TOXICITY IN MAN OF HEXAVALENT URANIUM FOLLOWING INTRAVENOUS ADMINISTRATION. A. J. Lassenhop, J. C. Gallimore, W. H. Sweet, E. G. Struxness, and J. Robinson (Massachusetts General Hospital, Boston and Oak Ridge National Lab., Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 83-100(1958) Jan.

3535

ON THE REVEALING TOXIC PROPERTIES IN THE BLOOD OF IRRADIATED ANIMALS IN EXPERIMENTS WITH ADRENALECTOMISED MICE AND RATS. P. D. Gorizontov and S. A. Davidova. Med. Radiol. 2, No. 5, 51-5(1957) Sept.-Oct. (In Russian)

Effects of blood serum from irradiated and normal animals on the mortality rate of mice and rats are discussed. It is shown that the blood serum from animals exposed to ionizing radiation becomes toxic in large doses to adrenalectomized mice and rats. During the first 24 hours after irradiation the blood of irradiated rats and dogs was not toxic and even retarded the death of adrenalectomized mice. (tr-auth)

Tracer Applications

Refer also to abstract 3810.

3536

A RADIOISOTOPE METHOD OF BLOOD POOLS. Abbas M. Rejali, William J. MacIntyre, and Hymer L. Friedell (Western Reserve Univ., Cleveland, Ohio). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 129-37(1958) Jan.

3537

DISTRIBUTION OF STRONTIUM-90 IN POND WEED AND FISH. K. W. E. Bidwell and Eileen E. Foreman (United Kingdom Atomic Energy Authority, Windscale Works, Sellafield, Cumberland). Nature 180, 1195-6(1957) Nov. 30.

3538

INFLUENCE OF DIETARY POTASSIUM ON POTASSIUM-42, RUBIDIUM-86 AND CESIUM-134 RETENTION IN THE RAT. F. R. Mraz and Homer Patrick (Univ. of Tennessee-Atomic Energy Commission Agricultural Research Program, Oak Ridge, Tenn.). Proc. Soc. Exptl. Biol. Med. 96, 497-9(1957) Nov.

An increase in dietary potassium has been shown to increase excretion of cesium-134, potassium-42 and rubidium-86. Interpretation of the first significant increase in excretion of these radionuclides as being the point at which dietary potassium is adequate would place the potassium requirement of the rat between 0.075 and 0.15%, probably between 0.1 and 0.15%. This is supported by the growth data. (auth)

3539

TISSUE CULTURE AS A RADIOBIOLOGICAL METHOD OF RESEARCH. Henni Gärtner. Strahlentherapie 103, 620-7(1957). (In German)

On the strength of accumulated experience and taking into consideration the experimental results of his own, the author gives a critical description of tissue-cultivation as a radio-biological method of research. Not only the advantages of the method, but the limits of its possibilities are discussed. The methods of evaluation show, that the trial object permits a multiple, combined assertion about the radio-biological efficaciousness of the selected doses and kinds of radiation and that thus, in one single object the possibilities of tests and countertests are given. Tissue cultivations, however, only represent a biological model of simplified histological structure. Therefore, no conclusions as to possible reactions of the entire organism should be drawn forthwith. (auth)

CHEMISTRY

3540 ANL-5054(Del.)

Argonne National Lab., Lemont, Ill.

CHEMISTRY DIVISION, SECTION C-I QUARTERLY REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1952. D. W. Osborne, ed. Feb. 1, 1953. Decl. with deletions Feb. 14, 1957. 35p. Contract W-31-109-eng-38. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on the following studies: the half life of Am^{243}; neutron capture cross sections for Ac^{227}; U^{233} recovery from sea water by solvent extraction; corrosion of U, Pu, and U–Pu alloys in NaK; heats of formation of UH_3, UO_3, and UT_3; determination of the low-temperature heat capacity of UF_4; the reaction of $Th(NO_3)_4 \cdot 4H_2O$ with N_2O_5 in anhydrous HNO_3; determination of the reflection spectra of some solid Co(II) salts in the visible region; separation of Li isotopes, Ce–Th mixtures, and Ra–Ba mixtures by an electrogravitational method; theoretical studies of the transference cell; the isotope effect in the Br oxidation of ethanol; and the synthesis of trimethyl borate. (C.H.)

3541 BMI-864(Del.)

Battelle Memorial Inst., Columbus, Ohio.

FUSED SALT MIXTURES AS POTENTIAL LIQUID FUELS FOR NUCLEAR POWER REACTORS. R. C. Crooks, M. J. Snyder, and J. W. Clegg. Sept. 8, 1953. Decl. with deletions Feb. 20, 1957. 50p. Contract W-7405-eng-92. $7.80(ph OTS); $3.30(mf OTS).

Thirty-two salt compounds in mixtures which represented 94 multi-component salt systems were investigated in a search for new liquid fuels suitable for use in a high-temperature (500 to 1000°C) thermal nuclear power reactor. Mixtures tested by differential thermal analysis for eutectic freezing temperatures and solvent capacity for U compounds contained combinations of fluorides, phosphates, sulfates, sulfides, and hydrosulfides of Bi, Ca, Pb, Li, Mg, K, Na, U, and Zn. The most promising fuel system was composed of mixtures of fluoride salts. Fluoride salt mixtures containing UF_4 froze at temperatures down to 392°C. Alkali-metal fluoride-phosphate mixtures dissolved over 20 mole % UF_4 and froze at temperatures down to 550°C (K_3PO_4-UF_4). US_2 reacted with but did not dissolve in a eutectic (305°C) mixture of NaSH and KSH. Differential thermal analyses indicated that US_2 dissolved in quantities of over 5 mole % at temperatures over 700°C in mixtures of alkali-metal sulfides. (auth)

3542 ISC-904
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN ENGINEERING FOR JANUARY–JUNE 1957. Sept. 11, 1957. 19p. Contract W-7405-eng-82. $0.50(OTS).

Progress is reported on: a bastnasite processing procedure; oxidation of Ce^{3+} in HNO_3; and liquid metal extraction of fission products from U. (For preceding period see ISC-836.) (T.R.H.)

3543 LA-2138
Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF A BATCH PROCESS FOR THE PRODUCTION OF A ZrO_2–UO_2 SOLID SOLUTION. S. W. Hayter, R. J. Bard, R. E. Smith, A. C. Dumrose, H. R. Baxman, J. P. Bertino, and J. A. Kircher. June 1957. 17p. Contract W-7405-eng-36. $0.50(OTS).

A batch process on the 2 kg scale was developed for the production of ZrO_2–UO_2 solid solution in the weight proportion of about 4 to 1. The product is tetragonal ZrO_2–UO_2 solid solution, with no UO_2 lines showing on the x-ray powder diffraction patterns. The solid solution is prepared from a precipitate of $Zr(OH)_4$–$(NH_4)_2U_2O_7$ which is filtered, dried, milled, screened to minus 325 mesh, and heated at 900°C in H_2 for 4 hours. The success of the preparation depends strongly on the conditions of the precipitation, with precipitation from dilute salt solution being necessary to avoid undissolved UO_2 in the final product. (auth)

3544 NYO-4804
Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
KINETICS OF REACTIONS BETWEEN LIQUID METALS AND LIQUID SALTS. Progress Report Covering Period March 1, 1957 to November 1, 1957. Thomas B. King. 14p. Contract AT(30-1)-1985. $3.30(ph OTS); $2.40 (mf OTS).

Progress made in the design of experiments, construction of apparatus, and preliminary experimental work is described. The kinetics of reactions involving both transport control and phase boundary reaction control are being studied. Measurements of diffusion coefficients are a part of the program. (auth)

3545 ORNL-870(Del.)
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1950. Mar. 1, 1951. Decl. with deletions Mar. 1, 1957. 153p. Contract W-7405-eng-26. $24.30(ph OTS); $7.50(mf OTS).

Chemistry of Source, Fissionable, and Structural Elements. Hydrolytic studies of $ThCl_4$ in solutions in perchlorate media are being extended to chloride media. Anion exchange studies have been extended to UO_2^{2+} in HNO_3 and H_2SO_4 solutions. Uranium is strongly adsorbed from the latter and weakly from the former. Solid phases observed in the system UO_2F_2–H_2O up to about 350°C are being identified. An ultracentrifuge study of aqueous UO_2F_2 solutions has been completed. Solubility measurements of fission-product sulfates are being made by two methods. Nuclear Chemistry. Decay schemes of the following isotopes have been studied: Sn^{125}, Sn^{123}, Nb^{96}, Tc^{96}, Xe^{133}, and Tc^{99}. Two full-scale fission-product-recovery runs have been made on the Chalk River waste. A split-crystal scintillation spectrometer has been devised to eliminate spurious low-energy pulses resulting from β scattering before complete absorption in the crystal. Radio-Organic Chemistry. Syntheses of several C^{14}-labeled compound are presented. The action of excess aqueous basic formaldehyde solution upon 9-formylfluorene-10-C^{14}-labeled formic acid was studied. An isotope effect has been demonstrated in H_2SO_4 dehydration of C^{14}-labeled formic acid. Chemistry of Separations Process. The reaction between ThF_4 and phosphorus fluorides appears to reduce the particle size of ThF_4 to 200 to 500A. There is some evidence that this facilitates subsequent removal of Pa^{233} in irradiated ThF_4 by fluorination. Several compounds have been synthesized for use in studies of solvent extraction including sulfones, alkyl phosphates, and labeled TBP. Separation of the Li isotopes by ion exchange has been studied. Chemical Physics. The apparatus for neutron diffraction has been improved by the introduction of automatic recording and of a new monochromator crystal (copper) giving an increase in intensity. Diffraction patterns of a number of substances, have been obtained. The determination of nuclear and molecular properties by microwave spectroscopy was continued. Radiation Chemistry. The study of the radiation decomposition and corrosion of aqueous UO_2SO_4 in stainless steel is discussed. The measurement of radiation dosage in chemical experiments has been put on a sounder basis by a calorimetric calibration of acid ferrous sulfate actinometer. Instrumentation. A scintillation survey meter for γ radiation has been designed and built. (W.L.H.)

3546 ORNL-2070(Del.)
Oak Ridge National Lab., Tenn.
ANALYTICAL CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING APRIL 20, 1956. H. P. Raaen, ed. May 1, 1956. Decl. with deletions Mar. 1, 1957. 59p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60(mf OTS).

Analytical procedures for the determination of Al, Cr, Li, Eu, Zr, N_2, F, and Sn are briefly discussed. Analytical instrumentation for the High-Radiation-Level Analytical Facility is described. Additional neutron activation cross sections are tabulated. The neutron activation determination of Co, Ta, Te, Se, As, Si, Cu, U, S, and Ag is reviewed. The induced radionuclides that have been identified in reactor structural materials are listed. Spectrochemical techniques for rare earth analysis and optical microscopy are discussed. Electron-diffraction data for sodium tungstate are reported. Additional analytical procedures are outlined for the determination of corrosion products in UO_2SO_4 solutions and in Th slurries. (C.W.H.)

3547 PWAC-235
Pratt and Whitney Aircraft Div., United Aircraft Corp., Middletown, Conn.
LIQUID-METAL SMOKE ABATEMENT. H. K. LeMar. Nov. 1, 1957. 34p. $1.00(OTS).

Some of the facilities at CANEL contain large quantities of liquid metal for testing purposes. In case of accidental leakage and resulting fire, large quantities of liquid metal smoke could be released which must be prevented from escaping from the building. Therefore, various systems of smoke abatement were tested in order to determine how to prevent smoke from escaping from these facilities. The following methods of liquid metal smoke abatement were analyzed and are discussed in this report: Pease-Anthony Venturi Scrubber (Chemical Construction Corporation); Peabody Scrubber (Peabody Engineering Corporation); Electrostatic Precipitator–Modified (Trion, Inc.); Capillary Cell Unit–Dynel Packed Cell (Air and Refrigeration Corporation); and Bonded Dynel Filter (Harvard School of Public Health–Air Cleaning Laboratory. Both the scrubber system and the electrostatic precipitator are recommended for use in liquid metal smoke abatement on the basis of smoke removal efficiency. On the basis of quoted costs, the Peabody scrubber will present the most economical installation. (auth)

3548 S and T Memo-5/57

Gt. Brit. Ministry of Supply. Technical Information and Library Services.

PRESENT KNOWLEDGE OF THE EXPLOSIVE TENDENCIES OF TITANIUM AND ZIRCONIUM (MARCH 1957). U. R. Evans. Apr. 1957. 17p. (AD-134750).

3549 UCRL-3950

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] JUNE, JULY, AUGUST 1957. Sept. 24, 1957. 113p. Contract W-7405-eng-48. $3.00(OTS).

Progress is reported in studies in bio-organic chemistry, nuclear chemistry, and process chemistry. Included is information on tracer studies on CO_2 metabolism in algae; tracer studies on the relationship between glutamic acid, glutamine, and α-ketoglutaric acid in photosynthesis in Chlorella; tracer studies on the effect of cyanide on the CO_2 fixation by algae; the response of Chlorella to a deuterium environment; tracer studies on glucose and carbon dioxide metabolism in fungi; tracer studies on photosynthesis in Chlorella grown with H_2O^{18} in which autoradiographs were made of paper chromatograms from algae extracts after transfer to metal sheets and bombardment with protons; tracer studies on radioactivity in Scenedesmus pigments; the incorporation of Fe^{59} into algae lipids; the possible effects of the specific activity of $C^{14}O_2$ upon photosynthesis in Chlorella; a microanalytical method for use in determining the concentration and specific activity of $KC^{14}N$; the intensification of x-ray-film images when x-ray film is used to obtain an autoradiogram of a chromatogram; tracer studies on the human metabolism of morphine; the snythesis of deuterated choline chlorides; the respiratory C^{14} patterns for D-, L-, and DL-norvaline-3-C^{14} in rats; and the level of various enzymes in rat brain, factors affecting the enzyme levels, and the effect of enzyme level on the behavior of rats. Investigations were continued on the formation of isotopes of Gd, the formation of cobalt isotopes by the bombardment of Ni foils, the formation of polymers of K, and the spectrochemical determination of the Sr-to-Ca ratio in samples of food, blood, milk, feces, and urine. (For preceding period see UCRL-3836.) (C.H.)

3550 USNRDL-TR-166

Naval Radiological Defense Lab., San Francisco.

SALT CONCENTRATION IN THE AIR AT BIKINI ATOLL (A PRELIMINARY STUDY). E. C. Evans, III. May 15, 1957. 52p. Project NS-088-001.

This preliminary study conducted at the Bikini Atoll investigated the variation of salt concentration in the first 300 ft of atmosphere by collection on specially developed silver dichromate reagent films. For a 10-knot wind maximum concentration appeared to exist at 50 to 75 ft above Mean Low Water Springs, with the possibility of a second maximum somewhere above 300 ft. Preliminary size-frequency counts showed a bimodal distribution of salt nuclei with maximum at 5 and 12 microns. (auth)

3551 AFOSR-TN-56-549

COMPARISON OF THE ELECTROMOTIVE FORCE SERIES IN VARIOUS SOLVENTS. Technical Note No. 5. H. Strehlow. Translated by George J. Janz from Z. Elektrochem. 56, 827-33(1952). 31p. Project Chem. 40-3. Contract AF18(600)-333. (AD-110368).

For the comparison of the emf series, two independent methods are considered. Firstly, the difference in the free energy of solvation of Rb^+ can be calculated approximately in various solvents from theoretical molecular concepts. Secondly, the order of the electromotive force series thus gained can be tested through the acidity measurements of solutions of strong acids in the specific solvents after Hammett. The results of the calculations are compared with the experimental data. (auth)

3552 TT-695

STERIC FACTORS OF RADICAL REACTIONS IN CHEMICAL KINETICS. (Stericheskie Faktory Radikal'nykh Reaktsii v Khimicheskoi Kinetike). A. D. Stepukhovich. Translated by G. Belkov from Uspekhi Khim. 25, 263-87 (1956). 48p.

Only the theoretical state of the problem of steric factors and the application of theoretical results obtained to some radical reactions are considered. (W.L.H.)

3553 TT-702

FLUORINE–HYDROXYL SUBSTITUTION ON HYDROXYLAPATITE AS AN ION EXCHANGE REACTION AND ITS APPLICATION TO MICRO-FLUORINE ANALYSIS. (Fluor–Hydroxyl–Substitution am Hydroxylapatit als Ionenaustauschreaktion und Ihre Anwendung fur die Mikrofluoranalyse). A. Knappwost. Translated by H. A. G. Nathan from Angew. Chem. 68, 371-3(1956). 11p.

The hydroxyl in hydroxylapatite may be exchanged for fluorine, and this exchange is largely reversible. The hydroxyl thus is a true ion exchanger, and this forms the basis for a method of micro-fluorine analysis, which is essentially free from systematic errors. (auth)

3554 TT-705

ACTIVATION ENERGY OF RADICAL REACTIONS. (Energii Aktivatsii Radikal'nykh Reaktsii). A. P. Purmal'. Translated by G. Belkov from Zhur. Fiz. Khim. 30, 172-6 (1956). 11p.

3555

HYDROTHERMAL SYNTHESIS OF ZIRCON, THORITE AND HUTTONITE. Clifford Frondel and R. L. Collette (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 42, 759-65(1957) Nov.-Dec.

Zircon and thorite have been synthesized by heating admixed SiO_2 and ZrO_2 or ThO_2 gels in water over the range 150°C and 4.8 bars to 700° and 3100 bars. Material synthesized at 150° shows strong absorption in the infrared at 2.75 μ due to hydroxyl, and apparently contains $(OH)_4$ in substitution for (SiO_4). Zircon containing an undetermined but quite small amount of Th and of U in solid solution has been synthesized at 400 to 700° from charges containing Zr: Th or U = 1 : 1; thorite of $(U, Zr)O_2$ are also formed. Thorite containing an undetermined amount of U in solid solution was obtained similarly. Huttonite has been synthesized hydrothermally at 300 and 700°. It is found that metamict natural thorite and zircon recrystallize when heated in water, at temperatures considerably below those needed when heated dry in air, and the presence of (OH) was verified by infrared study in one such recrystallized sample. (auth)

3556

DIRECT MEASUREMENT OF RADIOACTIVE SUBSTANCES IN LIQUIDS. K. Jordan. Atompraxis 3, 398-402(1957) Oct. (In German)

3557

INTERMITTENT MEASUREMENT OF RADIOACTIVE SUBSTANCES IN WATER. R. Neuwirth. Atompraxis 3, 402-4(1957) Oct. (In German)

3558

CONTINUOUS MEASUREMENT OF RADIOACTIVE SUBSTANCES IN WATER. W. Buchner. Atompraxis 3, 405-7 (1957) Oct. (In German)

3559

THE DIODIDE OF NIOBIUM. Marcel Chaigneau. Compt. rend. 245, 1805-6(1957) Nov. 18. (In French)

A diodide of Nb, NbI_2, has been obtained by hydrogen reduction of NbI_3. (tr-auth)

3560

PHENOMENA ASSOCIATED WITH DETONATION IN LARGE SINGLE CRYSTALS. T. E. Holland, A. W. Campbell, and M. E. Malin (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 28, 1217(1957) Oct.

3561

OXIDATION OF NIOBIUM BETWEEN 375°C AND 700°C. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Research Labs., Pittsburgh). J. Electrochem. Soc. 105, 4-9(1958) Jan.

Niobium has been found to oxidize in a complex manner. At 400°C and lower a slow rate of reaction is observed with the kinetics following the parabolic rate law. At a weight gain of 55 to 70 $\mu g/cm^2$ a transition in the kinetics occurs to a nearly linear rate law. Between 550° and 625°C the oxidation rate is nearly constant as a function of temperature, while above 625°C the oxidation rate again increases with the temperature. The adherence of the oxide is poor above the transition point. (auth)

3562

HEAT OF FORMATION OF TITANIUM TRIBROMIDE BY THE MERCURY REDUCTION OF TITANIUM TETRABROMIDE. Elton H. Hall and John M. Blocher, Jr. (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 105, 40-4(1958) Jan.

The experimentally determined heat of reaction, $\frac{1}{2}Hg_2Br_2(s) + TiBr_3(s) = TiBr_4(g) + Hg(l)$, $\Delta H_{475} = 23.0 \pm 1.2$ kcal is combined with existing data for $TiBr_4$, Hg, and Hg_2Br_2 to obtain for the heat of formation and standard entropy of $TiBr_3$, $\Delta H°_{f298.2} = -130.6 \pm 1.2$ kcal/mole and $S°_{298.2} = 43.4 \pm 1.6$ e.u. (auth)

3563

CHEMICAL RESEARCH AT THE ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL. R. Spence. Proc. Roy. Soc. (London) A243, 1-14(1957) Dec. 10.

Aerosols

3564

SEPARATION OF RADIOACTIVE AEROSOLS WITH FIBER FILTER. W. Zumach. Atompraxis 3, 377-82(1957) Oct. (In German)

Analytical Procedures

3565 AERE-C/R-2165 (Rpt: UNCLASSIFIED)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF LONG-LIVED FALLOUT IN RAINWATER. R. G. Osmond, A. G. Pratchett, and J. B. Warricker. Aug. 1957. 23p.

A method is described for the determination of the long-lived isotopes Sr^{89}, Sr^{90}, Ce^{144} and Cs^{137} in samples of rainwater. Some attention is paid to the development of the method including details of the checks to ensure adequate chemical and radiochemical purity of the final sources used for counting. (auth)

3566 ANL-5810

Argonne National Lab., Lemont, Ill.

THE DETERMINATION OF FISSION PRODUCT RUTHENIUM. R. P. Larsen, L. E. Ross, and Gwendolyn Kesser. Dec. 1957. 7p. Contract W-31-109-eng-38. $0.50(OTS).

Improvements in Glendenin's procedure for the determination of fission product ruthenium have been made. The distillation from perchloric acid has been replaced by a more rapid distillation from a dilute sulfuric acid–sodium bismuthate mixture. Conditions for the quantitative volatilization and collection of the tetroxide, as well as reduction to the dioxide, have been established. Reduction to the metal for a yield determination is no longer necessary. The analysis time has been halved and the precision has been improved by a factor of three. (auth)

3567 ORNL-1639(Del.)

Oak Ridge National Lab., Tenn.

ANALYTICAL CHEMISTRY DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING OCTOBER 20, 1953. Jan. 5, 1954. Decl. with deletions Feb. 20, 1957. 42p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Progress is reported on the polarographic determination of Eu in Li, development of analytical methods relative to ClF_3 process, vacuum-fission analysis of metals, development of an automatically recording internal-standard flame photometer, diaphragm-type pipette manipulator, r-f fusion apparatus for the preparation of NaF-U phosphors, electronically timed falling-drop instrument for the determination of densities of aqueous solutions, neutron activation cross sections of Fe^{58}, analysis of radioisotopes, recovery of U from graphite, activation determination Cl and I in biological materials, corrosion of stainless steel, and the analysis of U slurries and UO_2SO_4 solutions. (J.E.D.)

3568 TML-89

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

VACUUM-FUSION ANALYSIS FOR OXYGEN IN TITANIUM. W. R. Hansen, M. W. Mallett, and M. J. Trzeciak. Dec. 6, 1957. 25p. Contract AF18(600)-1375.

An investigation of the accuracy and reproducibility of vacuum-fusion methods currently used for determining oxygen in titanium and its alloys was conducted. Two vacuum-fusion techniques, platinum bath and dry crucible, were checked by experimentation. A third technique, one using an iron bath, had previously been shown to yield results comparable to those obtained by the dry-crucible method. Several variations of the platinum-bath technique were tried. The results were not reproducible. However, during the course of the work a new technique, platinum flux, was developed. The accuracy of the dry-crucible and the platinum-flux techniques as applied to unalloyed titanium, and one alloy, Ti–6Al–4V, was determined by using standard samples. Both techniques appeared capable of recovering at least 92 per cent of the oxygen in unalloyed titanium standards. However, in most cases the recovery was much better than this. Average oxygen recovery from Ti–6Al–4V alloy standards was 93 per cent by both the platinum-flux and the dry-crucible techniques. Studies on the reproducibility of analytical values made on three other alloys, Ti–8Mn, Ti–2Fe–2Cr–2Mo, and Ti–5Al–2.5Sn, indicated that satisfactory results could be obtained by both techniques. (auth)

3569 WAL-TR-833/7

Watertown Arsenal Lab., Mass.

MASS SPECTROMETRIC ANALYSIS OF LOW CONCENTRATION HD IN MIXTURES WITH HYDROGEN. Edward R. Washwell, William J. McMahon, and Arthur Kant. Nov. 1957. 9p. DA Project 5B99-01-004.

The investigation of the solubility of gases in metals, and in particular the solubility and exchange of H_2 and HD with Ti, requires development of mass spectrometric techniques for the precise analysis of low concentration deuterium in mixtures with H. This task involves the preparation of mixtures of H and HD of accurately deter-

mined compositions as well as the determination of various parameters of the mass spectrometer used. As a result of the determinations and preparations mentioned above, a precision of 2% or less is attained in the analysis of low concentration deuterium in mixtures with H. (auth)

3570

ION EXCHANGE SEPARATION IN THE ANALYSIS OF BISMUTH BASE ALLOYS. PART II. TERNARY ALLOYS CONTAINING URANIUM AND THORIUM. G. W. C. Milner and J. H. Nunn (Atomic Energy Research Establishment, Harwell, Eng.). Anal. Chim. Acta 17, 494-9(1957) Nov.

Procedures are described for the analysis of bismuth base alloys containing uranium and thorium in the range from 0.1 to 10%. The thorium is first separated by the passage of a solution of the sample in 5M hydrochloric acid through a column of Deacidite FF in the chloride form. For thorium contents greater than about 1%, the determination is completed volumetrically with EDTA using pyrocatechol violet as the indicator. Smaller amounts are determined absorptiometrically by the thoronol method. Uranium is recovered from the ion-exchange column in a quantity of 0.2M hydrochloric acid, bismuth still being retained by the column under these conditions. Uranium contents greater than about 1% are determined volumetrically after reduction to the tetravalent state with a lead reductor, while smaller amounts are determined polarographically using a tartrate base solution. (auth)

3571

VOLUMETRIC DOSE DETERMINATION OF STRONTIUM. P. Spacu and F. Popescu (Laboratory of Inorganic and Analytical Chemistry, Polytechnic Inst. of Bucharest). Bul. Inst. Politehnic, Bucuresti 18, Nos. 3-4, 185-7(1956) July-Dec. (In Rumanian)

A new method is offered for the volumetric determination of Sr in the form of iodite. A solution of $Sr(NO_3)_2$ is treated with KIO_3 in the presence of alcohol. The solution is agitated, precipitated, and filtered through a dry quantitative filter. Then the KI and H_2SO_4 are added to the filtrate, and by titration iodine is liberated with a solution of 0.1N $Na_2S_2O_3$. The method is very simple and can be applied with ordinary reagents. (tr-auth)

3572

RADIOCHEMICAL ANALYSIS. Denys Monnier. Industries Atomiques No. 9-10, 59-64(1957). (In French)

The great potentialities of radiochemical analysis are surveyed and the various general techniques are described and evaluated. The analysis of natural radioactive elements, analysis by activation, analysis by absorption, and isotopic dilution analysis are discussed. (T.R.H.)

3573

METHOD OF RADIOASSAY OF VOLATILE COMPOUNDS. Rolfe H. Herber (Univ. of Illinois, Urbana). Rev. Sci. Instr. 28, 1049-51(1957) Dec.

A rapid, convenient, and reproducible method has been developed for the radioassay of volatile materials labeled with beta emitters of more than 0.15-Mev energy. The sensitive detection element is a thin-walled aluminum G. M. tube sealed into an annular jacket and attached directly to a high-vacuum manifold. Analysis data for $SiCl_4^{36}$ are presented, and application of the method to several tracer problems is suggested. (auth)

3574

THE DETERMINATION OF URANIUM AND THORIUM IN URANO-THORIANITE AND MONAZITE BY THE "EQUILIBRIUM" METHOD. P. W. de Lange. Trans. Geol. Soc. S. Africa 59, 259-73(1956).

The "equilibrium" beta-gamma method for the analysis of ore samples has been investigated and some refinements were found necessary due to the gamma activity of the uranium group. For rather high grade urano-thorianite (non-leached) and Rand ore (leached) samples the use of 18 gm samples is suggested. Samples weighing 70 gm are used for low grade material, involving a slight alteration to the beta-counting unit. A minimum activity of 0.005% U_3O_8 or its equivalent in non-leached U-Th and leached U ores can still be assayed quantitatively. Application of the method to leached U-Th ore samples is also discussed. A detailed experimental procedure for the analysis of ore samples on the beta-gamma unit is given in one of the two Addenda. (auth)

Graphite

3575 NP-6514

Buffalo. Univ.

PROGRESS REPORT NO. 2 FOR SEPTEMBER 1, 1957 TO NOVEMBER 30, 1957. J. F. Andrew, J. Repetski, H. E. Strauss, and D. C. Wobschall. Dec. 1, 1957. 13p. Contract AF-33(616)-5186.

Preliminary studies of sounds occurring during carbon stressing, apparatus and techniques for determining elastic constants and thermal conductivity in graphite, and methods for the direct determination of the Poisson ratio are reported. (For preceding period see NP-6444.) (D.E.B.)

3576

THE EFFECTS OF POTASSIUM ON UNGRAPHITIZED CARBON. Nicole Platzer. Compt. rend. 245, 1925-8 (1957) Nov. 25. (In French)

The effects of potassium on ungraphitized carbon permits the distinguishing of graphitizable and ungraphitizable carbon. The former produces insertion compounds and also adsorbs the metal. In the case of the latter there is only adsorption of potassium and at high temperatures the graphitization is still limited to the surface of the grains. (tr-auth)

3577

INTERLAYER SPACINGS OF GRAPHITIC CARBONS. Nature 180, 1184-5(1957) Nov. 30.

3578

GRAPHITIC CHARACTER OF KISH. P. L. Walker, Jr. and George Imperial (Pennsylvania State Univ., University Park). Nature 180, 1185(1957) Nov. 30.

3579

QUANTITATIVE ESTIMATION OF GRAPHITE IN REFRACTORY CARBON DEPOSITS BY X-RAY TECHNIQUE. William A. Frad (Missouri School of Mines and Metallurgy, Rolla) and Paul G. Herold (Radio Corp. of America, Lancaster, Penna.). Nature 180, 1273-5(1957) Dec. 5.

Laboratories and Equipment

3580 DP-229

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A FLOW COLORIMETER FOR MEASURING URANIUM CONCENTRATION IN PROCESS STREAMS. Charles A. Prohaska. Aug. 1957. 20p. Contract AT(07-2)-1. $0.75(OTS).

A flow colorimeter was developed for measuring uranium concentration in aqueous or organic process streams. First order correction was provided for window fouling and changes in light intensity. The instrument performed satisfactorily in the Metal Recovery Plant at ORNL for a period of four months. (auth)

3581 KAPL-387

Knolls Atomic Power Lab., Schenectady, N. Y.

PROJECT SIR—REVISED PROPOSAL FOR THE RADIOACTIVE MATERIALS LABORATORY AT THE KNOLLS ATOMIC POWER LABORATORY. H. H. Race, R. H. Horton, J. P. Howe, J. R. Low, H. H. Zornig, F. A. Vernon, and C. H. Betts. Aug. 3, 1950. Decl. Feb. 25, 1957. 44p. Contract W-31-109-eng-52. $12.30(ph OTS); $4.50(mf OTS).

A facility needed for metallurgical examination of radioactive materials required during the design phase of the SIR program is described. The major objectives of this method of operation and some cost saving changes in cell design are summarized. Sections are included on the cost estimate, time schedule, metallurgical work program, operational requirements, building design and specifications, and cell design and specifications. (M.H.R.)

3582 WAPD-PWR-CP-3052

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

DECONTAMINABILITY OF STRUCTURAL MATERIALS AND SURFACE COATINGS FOR USE IN NUCLEAR INSTALLATIONS. R. Lloyd. May 28, 1957. 18p. $4.80(ph OTS); $2.70(mf OTS).

A standard procedure for washing under rigorously reproducible conditions was used to clean radioactive contamination from a variety of surface coatings and structural materials. Specific data on the clean-up properties of these materials are tabulated. (D.E.B.)

Molecular Structure

3583

ELECTRONIC ENERGY OF LiH AND BeH. James Miller, R. H. Friedman, R. P. Hurst, and F. A. Matsen (Univ. of Texas, Austin). J. Chem. Phys. 27, 1385-7(1957) Dec.

Valence bond calculations for LiH and BeH^+ have been completed. All twenty structures which can be written for 1s, 2s, and $2p_\sigma$ on the metal atom and 1s on hydrogen are considered. It was found that only six structures are of importance and that promotion of inner shell 1s electrons adds nothing to the description. The results for LiH agree well with those obtained by previous workers. (auth)

3584

PROTON RELAXATION IN WATER. S. Meiboom, Z. Luz, and D. Gill (Weizmann Inst. of Science, Rehobot, Israel). J. Chem. Phys. 27, 1411-12(1957) Dec.

Measurements of the proton relaxation times in water as a function of pH were made. The transverse relaxation time T_2 was measured by the spin-echo method. The longitudinal relaxation time T_1 was measured by the 180° to 90° pulse scheme. The water used was doubly distilled, but not degassed. Its pH was adjusted by the addition of HCl in the acid range and NaOH in the basic range, and measured with a glass electrode. It appears that the observed dependence of T_2 on pH is not due to the presence of Na^+ or Cl^- ions. The fact that T_2 is appreciably shorter than T_1 shows that part of the relaxation is caused by a slow mechanism, i.e., one characterized by a correlation time longer than the Larmor period. It is proposed that in the central pH range, the pertinent mechanism is the breaking and reforming of hydrogen bonds between water molecules. There is strong evidence that the hydrogen bonding causes a chemical shift of the proton resonance of the order of 100 cps (at 30 Mcps). (A.C.)

Radiation Chemistry

3585

HYDROGEN YIELDS IN AQUEOUS SODIUM NITRATE SOLUTION BY COBALT-60 GAMMA-RAY RADIATION. H. A. Mahlman and J.W. Boyle (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 27, 1434(1957) Dec.

In radiolysis of aqueous solutions hydrogen and hydrogen peroxide are initially observed products. These molecular products are thought to be produced by hydrogen atoms and hydroxyl radicals reacting with themselves as they diffuse away from the site where they are formed. It was shown that hydrogen and hydrogen peroxide yields in aqueous solution may be depressed by solutes. All irradiations were made utilizing a Co^{60} gamma-ray source. (A.C.)

3586

RESPONSE OF THE CERIC-CEROUS SYSTEM AT HIGH DOSE-LEVELS OF COBALT-60 γ-RAYS. B. Whittaker (Wantage Radiation Lab., Grove, Berks). Nature 180, 1302(1957) Dec. 7.

Radiation Effects

3587 HW-52814

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE EFFECT OF REACTOR IRRADIATION ON CANDIDATE ORGANIC COOLANTS. Final Report on PT-IP-11D; Interim Report I on PT-IP-50D. R. E. Woodley. Sept. 12, 1957. Decl. Dec. 12, 1957. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

To determine the effect of reactor irradiation on the properties of candidate organic coolants, two sets of five capsules each, which contained biphenyl, monoisopropyl biphenyl (MIPB), and mixtures of these two materials, were exposed in the 2A test hole of the KW reactor. Five sets of three capsules each, which contained biphenyl, MIPB, and monomethyl biphenyl were exposed in the Snout II test hole of the KW reactor. In the latter series of irradiations, the exposure temperature was varied by altering the extent of γ heating. The results obtained from these irradiations are presented. (M.H.R.)

3588 NP-6512

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 5 [ON RADIATION EFFECTS DATA]. Nov. 15, 1957. 39p. Project No. 2133. Contract AF33(616)-5171.

3589 NP-6519

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

ACCESSION LIST NO. 6 [ON RADIATION EFFECTS DATA]. Dec. 16, 1957. 40p.

3590

DISPLACED ATOMS IN SOLIDS. COMPARISON BETWEEN THEORY AND EXPERIMENT. G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Am. Soc. Testing Materials Spec. Tech. Publ. No. 208, 3-26(1957).

Bombardment with massive fast particles produces atomic displacements in a solid, and important changes in physical properties arise from the resultant atomic disorder. The calculation and measurement of the concentration of displaced atoms produced by nuclear radiations is discussed and, in particular, a critical comparison of theory and experiment is made. The theory of displacement production is outlined briefly. The number of atoms displaced in a solid by a given flux of bombarding particles of known energy can be calculated. It is assumed in the theory that the process can be described in terms of hard sphere collisions and that a definite threshold energy may be assigned to the displacement process. (auth)

3591
A SUMMARY OF THE EFFECT OF RADIATION ON SOME PLASTICS AND ELASTOMERS. O. Sisman and C. D. Bopp (Oak Ridge National Lab., Tenn.). Am. Soc. Testing Materials Spec. Tech. Publ. No. 208, 119-28(1957).

3592
THE PROBLEM OF ESTABLISHING SPECIFICATIONS FOR IRRADIATED ORGANIC MATERIALS. O. Sisman (Oak Ridge National Lab., Tenn.). Am. Soc. Testing Materials Spec. Tech. Publ. No. 208, 130-40(1957).

3593
POINT DEFECTS PRODUCED BY IRRADIATION AND THEIR ANNEALING IN IONIC AND COVALENT CRYSTALS. F. P. Clarke (Atomic Energy Research Establishment, Harwell, Berks). Discussions Faraday Soc. No. 23, 141-54(1957).

Atoms are displaced by interaction with energetic particles and point defects are produced. The diffusion of these defects to normal lattice positions may be described mathematically, using as basis a simple physical model, and the description obtained in this way accords with certain experimental data. On this treatment the activation energy for movement of any type of defect is considered to be a discrete quantity. Another method of describing these annealing phenomena is based upon the assumption that the rate processes follow a type of equation familiar in gaseous kinetics. It appears that if this description is to accord satisfactorily with certain experiments a distribution of activation energies has to be assumed. These different treatments are contrasted. (auth)

Rare Earths and Rare-earth Compounds

3594
THERMAL DECOMPOSITION OF SCANDIUM, YTTRIUM, AND RARE EARTH METAL OXALATES. Wesley W. Wendlandt (Texas Tech. Coll., Lubbock). Anal. Chem. 30, 58-61(1958) Jan.

The thermal decomposition of the oxalates of scandium, yttrium, lanthanum, cerium(III), praseodymium, neodymium, samarium, europium, gadolinium, holmium, and erbium was studied on the thermobalance. The hydrate water began to come off in the temperature range of 40° to 60°C. In certain cases, intermediate weight levels were found for the 6- and 2-hydrates. The anhydrous oxalates appear to be very unstable; no weight levels were found with this composition. The oxide levels were obtained in the temperature range of 360° to 800°C. (auth)

3595
PARAMAGNETIC RESONANCE IN THE 10,000 Mc BAND OF EUROPIUM AND GADOLINIUM SUBJECTED TO A CUBIC CRYSTALLINE FIELD. Charles Ryter. Helv. Phys. Acta 30, 353-73(1957). (In French)

Bivalent Eu and trivalent Gd appear as impurities in natural fluorite, CaF_2. They were subjected to an electric field of cubic symmetry, and both were in a $^8S_{7/2}$ ground state. The paramagnetic resonance spectra observed at 10,000 Mc permitted the deduction of total base separation ΔE, the ratio R between the three Stark sub-levels which are slightly different from 3/5, and the Landé factor, g. We found the following values; for Gd^{3+}: E = 0.1491 ± 0.0008 cm^{-1}, R = 0.596 ± 0.002, g = 1.9918 ± 0.0010; for Eu^{2+}: ΔE = 0.1784 ± 0.0009 cm^{-1}, R = 0.612 ± 0.003, g = 1.9927 ± 0.0010. For Eu the hyperfine structure of the 2 isotopes is resolved for the 001 direction of the magnetic field. The ratio of nuclear moments and the coupling constants found are: K_{151} = 32.62 ± 0.10 gauss; K_{153} = 16.23 ± 0.10 gauss; μ_{151}/μ_{153} = 2.26 ± 0.02. The hertzian spectrograph used for these experiments permits study of the paramagnetic absorption by eliminating scattering. It is briefly described, and the scheme of the new elements is given. (T.R.H.)

3596
THEORY OF THE PARAMAGNETIC RESONANCE OF EUROPIUM AND GADOLINIUM SUBJECTED TO A CRYSTALLINE CUBIC FIELD. Roger Lacroix. Helv. Phys. Acta 30, 374-94(1957). (In French)

The effect of a cubic crystalline field on Eu^{2+} and Gd^{3+} was studied by following the variation of the Russell-Saunders coupling. The magnetic spectrum was calculated by a series expansion for a raised magnetic field making some angle with the crystalline axes. The repercussion of the fine structure on the hyperfine, by intermediate secondary effects, is shown as well. (tr-auth)

Separation Procedures

3597 CF-53-5-210
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION CHEMICAL PROCESSING. Quarterly Report [for] February 10, 1953 to May 10, 1953. G. I. Cathers and D. E. Ferguson. May 27, 1953. Decl. July 5, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An aqueous solution of ARE $UF_4-NaF-ZrF_4$ fuel, suitable for solvent extraction, may be obtained by reaction with dilute $Al(NO_3)_3-HNO_3$ solution under reflux conditions. Optimum proportions are five parts of $Al(NO_3)_3$ monahydrate, seven parts acid, and eleven parts of water to one part ARE fuel by weight. The resultant U concentration is 4.3 g per liter, if the fuel is undiluted with any flush material. Batch countercurrent runs have shown the feasibility of recovering and decontaminating U from the ARE fuel by solvent extraction. U losses of less than 0.01% in the fission product stream and decontamination factors of over 10^4 were obtained using a five % solution of TBP in Amsco as the solvent. Tests have shown that dissolution of the ARE fuel at boiling temperature will cause considerable corrosion to either type 309 or type 347 stainless steel. The corrosion rate may be tolerable, however, on a non-routine basis in vessels which have already been exposed to corrosive HNO_3. Discussions have resulted in the conclusion that processing of ARE fuel (70 kg U^{235} per batch) is possible in the present ORNL Metal Recovery Plant without major equipment additions. (auth)

3598 DOW-57
Dow Chemical Co. Western Div., Pittsburgh, Calif.
THE RECOVERY OF URANIUM BY ION EXCHANGE FROM ACID LEACHES OF CARNOTITE ORES. R. R. Grinstead and W. J. Backer. Aug. 10, 1951. Changed from OFFICIAL USE ONLY Dec. 12, 1957. 133p. Contract AT-30-1-GEN-236. $21.30(ph OTS); $6.90(mf OTS).

An ion exchange process for the recovery of U from acid leaches of carnotite ores is described. The coincident recovery of V by ion exchange has not been found to be practical but alternate chemical methods have been investigated. (auth)

3599 HW-10277
Hanford Works, Richland, Wash.
ZIRCONIUM PHENYLARSONATE TRACER SCALE METHOD FOR THE DIFFERENTIATION OF Pu(III) AND Pu(IV) IN REDOX SOLUTIONS. C. H. Ice. June 30, 1948. Decl. Feb. 18, 1957. 11p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

An estimation was made of the amount of Pu(III) and Pu(IV) present in the IBP stream in the Redox process. This work was undertaken in order to establish an analytical method suitable for routine control analysis. A procedure based on carrying of Pu(IV) upon a Zr phenylarsonate precipitate has proven satisfactory. The method employed and analytical results obtained from known solutions are described. An average recovery of 98.5% on Pu(III) and 97.7% on Pu(IV) was obtained from 50-50 mixtures. The standard deviation for individual results was 1.7%. When the Pu(III) to Pu(IV) ratio is five, similar results are obtained. However, as the Pu(III) to Pu(IV) ratio decreases, the accuracy of the method also decreases. From the data obtained, it appears that the Zr phenylarsonate method should be satisfactory for analysis for Pu(III) and Pu(IV) in the IBP stream. It should be noted that the method is applicable only under a limited set of conditions and the degree of accuracy obtainable should be taken into full consideration when reporting results. (auth)

3600 ISC-6
Iowa State Coll., Ames.
PROGRESS REPORT IN METALLURGY. May 1, 1947. Decl. Mar. 28, 1957. 83p. Contract W-7405-eng-82. $13.80(ph OTS); $4.80(mf OTS).

Progress is reported in studies on the liquid-liquid solvent extraction and purification of Th nitrate; the preparation of Th fluoride; the reduction of Th fluoride to Th metal; the casting of Th; Be metal production by open pot and bomb reduction; the production of Be fluoride; the preparation of pure rare earth salts and rare earth metals; properties of Cu–Th and Ni–Th systems; the development of low-melting Pb–Sn–Bi–Tl and Pb–Sn–Bi–Ga alloys; the preparation of Ti by bomb reduction; and the preparation of high-temperature thermocouples. (C.H.)

3601 KLX-1034
Kellex Corp., New York.
REPORT OF THE INSTRUMENT AND MECHANICAL DEVELOPMENT DEPARTMENT ON METERING PUMPS. Job 15. June 30, 1949. Decl. Mar. 25, 1957. 192p. [For Hanford Works]. Contract W-31-109-Eng-52. Subcontract G-148. $30.30(ph OTS); $8.70(mf OTS).

Tests on various metering pumps and turbine pumps for Redox Process equipment are reported. Results indicated that a modified Lapp Pulsafeeder Pump was preferable. (L.M.T.)

3602 ORNL-1548
Oak Ridge National Lab., Tenn.
PUREX PROCESS LABORATORY DEVELOPMENT PROGRESS REPORT [FOR PERIOD] AUGUST 1952 THROUGH JANUARY 1953. J. R. Flanary, H. J. Groh, Jr., L. E. Line, Jr., and V. J. Reilly. July 30, 1953. Decl. Mar. 5, 1957. 50p. Contract W-7405-eng-26. $7.80 (ph OTS); $3.30(mf OTS).

This report describes further laboratory development of the Purex process. The results of comprehensive studies of solvent degradation and regeneration, continued investigation of final purification steps for the U product, and miscellaneous process experimental work are presented. (J.E.D.)

3603 ORNL-2005(Del.)
Oak Ridge National Lab., Tenn.
CHEMICAL SEPARATION OF ISOTOPES SECTION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1955. Feb. 23, 1956. Decl. with deletions Mar. 4, 1957. 34p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

The countercurrent gas-liquid system $BF_3(g)$–anisole-$BF_3(l)$ for the concentration of boron isotopes has been studied. The single-stage separation factor varies from 1.039 at 0°C to 1.029 at 30°C. Rate of exchange is rapid, and, with efficient contacting equipment, complete exchange may be obtained in less than 15 sec. The vapor pressure of BF_3 over the complex rises sharply as the temperature is increased. From vapor-pressure measurements, an approximate upper limit of $\Delta H = -12$ kcal per mole of complex was calculated for the reaction $BF_3(g)$ + Anisole(l) ⇌ Anisole-$BF_3(l)$. Qualitative tests indicate good resistance of anisole to decomposition by BF_3 under plant conditions. The single-stage, equilibrium separation factor for the Nitrox system is a function of acid concentration. AT 26°C the factor ranges from 1.064 with 1M acid to 1.020 with 15M acid. A contactor is described for studies on gas-liquid equilibria. The nitrogen-isotope separation factor for the system NO(g) vs $FeNO^{++}$(aq) was found to be 1.009 at 16.5°C. The N^{15} concentrated in the liquid phase. The fractionation of nitrogen isotopes between aqueous ammonium hydroxide and metal-ammonia complexes adsorbed on Dowex 50 resn is being studied. A number of experiments have been performed to evaluate the ammonium resin–ammonium hydroxide moving-band ion-exchange system for enriching the isotopes of nitrogen. A separating factor of 1.027 (24°C) was measured, and the total separation was shown to decrease upon increasing the rate of band travel. A number of platinum metals have been investigated as possible heterogeneous catalysts for the low-temperature hydrogen–water exchange. Rhodium was found to be an active exchange catalyst. The equilibrium distillation of N_2O_4 has been found to enrich N^{15} in the liquid phase and O^{18} in the gaseous species. Estimated single-stage separation factors are approximately 1.004 for both N^{15} and O^{18} concentration. It has been found that the $B^{10}F_3$·dimethyl ether complex produced by the multi-stage distillation of BF_3·dimethyl ether complex is more than three-fold enriched in O^{18}. The effective single-stage separation factor for oxygen separation by this system is estimated to be greater than 1.01. The equilibrium constant for the reaction $NaK^{41} + K^{39}I(DMC) = NaK^{39} + K^{41}I(DMC)$ was found to be approximately 1.015 at 23°C. (auth)

3604 ORNL-2399
Oak Ridge National Lab., Tenn.
PROGRESS REPORT ON RAW MATERIALS FOR AUGUST 1957. Chemical Technology Div. K. B. Brown, C. F. Coleman, D. J. Crouse, and A. D. Ryon. Nov. 12, 1957. 29p. Contract W-7405-eng-26. $1.00(OTS).

Systematic Studies. Solvent extraction of UO_2SO_4 with a mixture of amines was studied and compared with other amines and mixtures. The method for preparing tri-n-octylphosphine oxide was shortened and improved. Process Development. Tris(tridecyl) amine was evaluated as a potential Amex extractant. Methods for limiting the phosphate content of Dapex vanadium products to specification were investigated. Engineering Studies. Scaleup factors for gravity settlers were determined for the extraction section of the Dapex uranium process, and the flow capacities of 6-, 22-, and 48-in. mixer-settlers were correlated. Fundamental Studies. The solvent extraction behavior of tri-n-octylamine in benzene and chloroform diluents was compared. (For preceding period see ORNL-2388.) (T.R.H.)

3605 UCRL-3934
California, Univ., Berkeley. Radiation Lab.
THE ISOLATION OF AMERICIUM-241 IN 100-MILLIGRAM QUANTITIES FROM LARGE AMOUNTS OF IMPURITIES. Fritz Weigel. Sept. 1957. 32p. Contract W-7405-eng-48. $1.00(OTS).

The preparation of pure americium samples on the order of 100 mg is described. The type of processing depends largely on the individual starting material. It is most strongly influenced by the presence of lanthanides—especially lanthanum itself—which are difficult to separate from the americium. The separation procedures used on five different starting materials are described, and the efficiency of some separation methods is discussed in view of personal experience. (auth)

3606 WIN-71

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF SCHWARTZWALDER RALSTON CREEK ORE. E. S. Porter and H. I. Viklund. Nov. 4, 1957. 30p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

3607 WIN-80

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH—FILTRATION PILOT PLANT GLOBE—VITRO BLEND. G. R. Pitmon and Guy Winslow. Dec. 12, 1957. 32p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

A blend of Globe Mining Company and Vitro Stockpile ores from the Gas Hills district of Wyoming was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. This report contains detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of this ore. Pachuca leaching was employed and the circuit liquors contained organic material that was detrimental to clarification and precipitation and the results show that the ore was not amenable to the Alkaline Leach–Filtration process unless a special additive was used. (auth)

3608 Y-488(Rev.)

Carbide and Carbon Chemicals Corp. Y-12 Plant, Oak Ridge, Tenn.

THE CONCENTRATION OF U^{235} BY CHEMICAL EXCHANGE IN COMBINATION WITH COUNTERCURRENT ELECTROMIGRATION. L. P. Twichell, R. D. Williams, and A. Clark. Aug. 22, 1949. Decl. Sept. 4, 1957. 44p. Contract W-7405-eng-26. $0.45(OTS).

It has been previously shown that U^{235} concentrates to a slight extent as UO_2^{2+} in the U^{4+}–UO_2^{2+} aqueous system. In this report a method is described for a continuous chemical process in which the U^{235} isotope has been successfully concentrated by a chemical exchange reaction. In this method U^{4+} and UO_2^{2+} move countercurrently to each other by the countercurrent electromigration principle which was developed to concentrate certain isotopes of potassium, chlorine, and copper. When this method is applied to the U^{4+}–UO_2^{2+} system, the U^{4+} moves countercurrently to UO_2^{2+}, and the concentration of U^{235} should increase in the UO_2^{2+}; correspondingly, the concentration of U^{238} should increase in the U^{4+}. It was found that UO_2^{2+} could be washed from cathode to anode by a stream of electrolyte which flowed countercurrently to the U^{4+} migrating to the cathode. One cell was operated for 1400 hours to increase the concentration of U^{235} from 0.7111 to 0.7171%. Details of the method and the difficulties encountered in its operation are described. (auth)

3609 Y-785

Oak Ridge National Lab., Y-12 Area, Tenn.

APPLICATION OF LIQUID-LIQUID SYSTEMS TO THE SEPARATION OF LITHIUM ISOTOPES. J. S. Drury. June 28, 1951. Decl. Mar. 6, 1957. 22p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A systematic effort to develop a liquid-liquid system suitable for the separation of lithium isotopes is described. The study included a search for immiscible solvent pairs; preparation of a number of lithium compounds, solubility studies of lithium compounds in individual solvents, distribution studies of lithium compounds in two phase liquid-liquid systems; and determination of isotopic shift in certain selected systems. No measurable isotopic enhancement was found in any of the systems studied. (auth)

3610

CONTINUOUS COLD TRAP FOR FLUORIDE VOLATILITY PROCESSING OF URANIUM. J. C. Bresee and P. R. Larson (Massachusetts Inst. of Tech., Oak Ridge, Tenn.). Ind. Eng. Chem. 49, 1349-54(1957) Sept.

Reprocessing of enriched U solid fuels by both volatilization from a fused salt, and sorption-desorption purification, requires final condensation of UF_6 in a solids condenser or cold trap. Work has been done to develop a fluidized condenser for a continuous cold trap. Using the system, I–N, and an internally cooled fluidized bed of inert carrier, tests showed that a fluidized cold trap design is feasible. In addition to the potential advantage of continuous operation, the fluidized condenser principle may reduce heat transfer area requirements by more than a factor of 10 when compared with a batch cold trap. (auth)

3611

ON THE ENRICHMENT OF ARSENIC-76 BY HOT-ATOM EFFECT. Nobufusa Saito, Michiaki Furukawa, and Isao Tomita (Univ. of Tokyo, Japan). J. Chem. Phys. 27, 1432-3(1957) Dec.

3612

THE EFFECT OF TEMPERATURE ON ION-EXCHANGE EQUILIBRIA. I. THE SODIUM-HYDROGEN AND CUPRIC-HYDROGEN EXCHANGES. O. D. Bonner and Linda Lou Smith (Univ. of South Carolina, Columbia). J. Phys. Chem. 61, 1614-17(1957) Dec.

Ion-exchange reactions between sodium and hydrogen and between cupric and hydrogen ion on sulfonic acid type (Dowex 50) resins have been studied over the temperature range 0 to 97.5°. The equilibrium constant, K_H^{Na} is greater than unity over this entire temperature range, and decreases with increasing temperature. The equilibrium constant K_H^{Cu} is also greater than unity over this entire temperature range but increases with increasing temperature. This produces negative values of ΔH^0 and ΔS^0 for the former exchange reaction and positive values of these thermodynamic functions for the latter. The variation of the equilibrium constants with temperature is believed to be caused primarily by the change of activity coefficients of the ions in the resin phase. (auth)

3613

THE ADSORPTION OF ZINC(II) ON ANION-EXCHANGE RESINS. I. THE SECONDARY CATION EFFECT. R. A. Horne (massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 61, 1651-5(1957) Dec.

The adsorption of tracer quantities of zinc(II) on the anion-exchange resin Dowex 1-X8 chloride from solutions of various chloride concentrations depends on the nature of the cation (secondary cation) of the supporting chloride electrolyte. The adsorption of zinc(II) from LiCl, $CaCl_2$, $MgCl_2$, NaCl, LiCl and HCl, HCl, KCl, CsCl, NH_4Cl, and $HONH_3Cl$ has been studied at 25° and the results interpreted in terms of ionic association of the secondary cation with anionic zinc(II) chloride complexes (a) in the resin and solution phases and (b) in the resin phase only. (auth)

3614

THE ADSORPTION OF ZINC(II) ON ANION-EXCHANGE RESINS. II. STOICHIOMETRY, THERMODYNAMICS, LOADING STUDIES, DOWEX-2 ABSORPTION AND FACTORS INFLUENCING THE RATE OF THE ADSORPTION

PROCESS. R. A. Horne, R. H. Holm, and M. D. Meyers (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 61, 1655-61(1957) Dec.

The adsorption of macroscopic amounts of zinc(II) on Dowex 1-X8 chloride has been studied at room temperature; the chloride content of the resin doubles with the equivalent adsorption of zinc(II) species. The adsorption of tracer zinc(II) on Dowex 1-X8 chloride from LiCl and HCl solutions at 0.25 and 49° has been studied, and the results indicate the presence of a secondary process resulting in apparent resin adsorption at high LiCl concentrations. Loading studies indicate that the equivalent capacity of Dowex 1 for zinc(II) chloro-complex ions is the same as for chloride ion, thus rendering unlikely the supposition that the adsorption process is other than ion exchange with the resin functional groups. The adsorption of tracer zinc(II) on Dowex 2 from HCl and LiCl solutions, while somewhat less, is substantially the same as on Dowex 1. The influence of resin mesh and amount, the concentration of various constituents in the solution phase, and solvent composition on the rate of the adsorption and desorption processes has been studied together with the rate of exchange of radiozinc(II) between resin and solution phases. (auth)

3615

THE ADSORPTION OF ZINC(II) ON ANION-EXCHANGE RESINS. III. THE ADSORPTION FROM BROMIDE, FLUORIDE, CYANIDE, OXALATE, ACETATE, NITRATE, PHOSPHATE, SULFATE, AND ALKALINE MEDIA; THE PERCHLORATE EFFECT, AND THE ADSORPTION FROM MIXED SOLVENT MEDIA. R. A. Horne, R. H. Holm, and M. D. Meyers (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 61, 1661-5(1957) Dec.

Zinc(II) adsorbs on Dowex 1-X8 from bromide, fluoride and oxalate media but not from acetate, nitrate, sulfate and alkaline media. The adsorption curve from HBr at 24.8 ± 0.2° has been interpreted to yield the following constants for the formation of $ZnBr^+$, $ZnBr_2$, $ZnBr_3^-$ and $ZnBr_4^=$: 1.0, 0.7, 0.5 and 0.3. The presence of perchlorate ion markedly depresses the adsorption of zinc(II) on Dowex 1 chloride from HCl solution. In mixed solvent media of dielectric constant lower than that of water the differences in the adsorption of zinc(II) from HCl and LiCl solution observed in the case of aqueous solutions tend to diminish, the adsorption peak is shifted to lower chloride concentrations, and the value of the adsorption coefficient at the peak is increased: these observations are explained in terms of the decreased dielectric constant of the medium resulting in changes in the extent of ionic association. (auth)

Sorption Phenomena

3616

HEAT CAPACITY AND HEAT OF ADSORPTION OF ARGON ADSORBED ON GRAPHON. R. J. Bobka, R. E. Dininny, A. R. Siebert, and E. L. Pace (Western Reserve Univ., Cleveland, Ohio). J. Phys. Chem. 61, 1646-8(1957) Dec.

Heat capacities of argon adsorbed on Graphon were determined calorimetrically in the range 55 to 88°K, for surface coverages of 0.301, 0.609 and 0.921 fractions of a monolayer. The data indicate the existence of maxima at temperatures below 55°K, with the height of each maximum increasing as coverage decreases. The magnitude of the heat capacity at these maxima, particularly at the lowest coverage, could not be justified solely on the basis of a localized to mobile transition of the type predicted by Hill. An isosteric heat of adsorption was determined calorimetrically for this system at 87.5°K for surface coverages from 0.165 to 1.25 monolayers. The general shape of the curve agrees with other studies of the system and, in particular, confirms the presence of a maximum isosteric heat of adsorption at about 0.75 fraction of a monolayer. This maximum is interpreted as being due to a prominence of argon–argon interactions on a relatively homogeneous surface. (auth)

Spectroscopy

3617

FLUORESCENCE SPECTRA OF URANIUM, NEPTUNIUM, AND CURIUM. John G. Conway, James C. Wallmann, B. B. Cunningham, and George V. Shalimoff (Univ. of California, Berkeley). J. Chem. Phys. 27, 1416-17(1957) Dec.

Syntheses

3618 NAA-SR-2144

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE SYNTHESIS OF BIPHENYL-2,2',4,4',6,6'-d_6. J. M. Scarborough. Dec. 1, 1957. 11p. Contract AT(11-1)-GEN-8. $0.50(OTS).

Biphenyl-2,2',4,4',6,6'-d_6 has been synthesized. Aniline hydrobromide undergoes an exchange reaction with D_2O to yield aniline-N,N,2,4,6-d_5 hydrobromide-d which is converted to bromobenzene-2,4,6-d_3 by the Sandmeyer reaction. The resulting bromobenzene-2,4,6-d_3 is coupled in the presence of C_2H_5Br and $CoCl_2$ to form biphenyl-d_6. (auth)

Transuranic Elements and Compounds

Refer also to abstract 3605.

3619 ANL-5804

Argonne National Lab., Lemont, Ill.

AN X-RAY SPECTROMETRIC METHOD FOR DETERMINATION OF PLUTONIUM IN SOLUTION. D. S. Flikkema and R. V. Schablaske. Nov. 1957. 11p. Contract W-31-109-eng-38. $0.50(OTS).

It is shown that the method of x-ray emission spectrometry can be extended advantageously to the determination of plutonium in solution. Since K and L x-ray emission from the elements of higher atomic number is not measurably influenced by valence state of the emitting atom or ion, this physical method is especially attractive for elements such as plutonium whose chemistry is intricate and whose chemical analysis is complicated by several valence states existing in solution. Nor is it affected by variations in isotopic content as is the widely used radiochemical assay for plutonium. With a total amount of plutonium between 0.4 and 0.8 mg the standard deviation of a single result is less than 1 per cent. For samples of diverse origin interferences are eliminated, usually by simple chemical pre-treatment or by separation procedures, to give a clean solution for analysis. On the other hand, for large numbers of samples with a comparable matrix, it is worthwhile to devise calibration standards so that such samples can be analyzed directly. (auth)

3620 HW-51655

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

OXIDATION OF PLUTONIUM(III) BY SODIUM NITRITE. A. Brunstad. July 17, 1957. Decl. Nov. 12, 1957. 12p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

The reaction velocity constant for the oxidation of Pu(III) by nitrite in HNO_3 solution containing ferrous sulfamate is given. The reaction rate was found to be measurable by means of spectrophotometry. The data indicate the reaction to be a pseudo first-order reaction in the region of HNO_3 and nitrite concentration of interest. The reaction velocity constant, expressed as a first-order reaction with respect to Pu, was found for several values of HNO_3 and nitrite concentrations. The HNO_3 reaction velocity constant relationship is given. The oxidation of the ferrous sulfamate–Pu(III Pu(III) solution proceeds successively through the sulfamate, ferrous, and Pu(III) ions. An autocatalytic mechanism is associated with the oxidation of both ferrous and Pu ions which obviates the possibility of simple calculations of constants based on nitrite concentration. An empirical relationship between the reaction velocity constant and the (added) nitrite concentration is given. (auth)

3621 LA-2153
Los Alamos Scientific Lab., N. Mex.
ELECTROPHORETIC DEPOSITION OF PLUTONIUM. A Feasibility Study. K. A. Walsh. July 18, 1957. 13p. Contract W-7405-eng-36. $0.50(OTS).

Electrophoretic deposition of plutonium hydride from suspensions in n-butyl alcohol and other organic liquids was examined for its feasibility in the preparation of thin sections of plutonium metal. Dispersions of plutonium hydride in the solvent medium were produced by wet milling. Addition of trace amounts of butyric acid prior to the milling operation was necessary for deposition of plutonium hydride on nickel or tantalum electrodes with the application of 600 to 1000 volts to suspensions of the hydride in purified n-butyl alcohol. Vacuum drying of the deposits at room temperature was followed by thermal decomposition of the hydride at 450°C. A final heating at 525°C removed the last traces of hydrogen and sintered the deposit to produce a smooth, hard, adherent coating. Interaction of plutonium hydride and the solvent vehicle during milling leads to the formation of a mixture of metallic Pu, PuO, and Pu_2O_3 in the sintered product. The successful application of an electrophoretic process depends on the choice and availability of an inert solvent vehicle. (auth)

Uranium and Uranium Compounds

3622 MITG-A57
Massachusetts Inst. of Tech., Watertown, Mass. Mineral Engineering Lab.
RADIOASSAY OF LEACH SOLUTIONS AND RESIDUES. Wilfred Freyberger and Emilia M. Rubino. Feb. 28, 1949. Decl. Mar. 7, 1957. 33p. Contract W-7405-Eng-85. $4.80(ph OTS); $2.70(mf OTS).

The changes of leach-product activity with time were measured as a function of the time of leaching for ore samples. Solutions showed a decrease in activity, made up a long-lived decay and a short-lived decay. Residues showed a growth similar to the growth of radon. The routine radiometric analysis of leach solutions from four ores was undertaken; counter assays varied from chemical assays by ±0.0075 g U_3O_8/liter over the range of assays measured. Preliminary assays of residues from one ore were attempted, and a linear relation between counting rate and chemical analysis was found. (auth)

3623 ORNL-155
Oak Ridge National Lab., Tenn.
DECOMPOSITION UNDER PILE RADIATION OF CONCENTRATED SULFURIC ACID AND SOLUTIONS OF HEXAVALENT URANIUM IN CONCENTRATED SULFURIC ACID. J. W. Boyle, and A. O. Allen. Sept. 13, 1948. Decl. Mar. 6, 1957. 10p. Contract W-7405-eng-26. $0.25 (OTS).

Anhydrous H_2SO_4 shows very little chemical reaction under pile radiation. The presence of dissolved U, however, induces extensive decomposition to SO_2 and oxygen. The effect is purely chemical and independent of the existence of fission in the solutions, as it is shown by solutions of "depleted" U containing practically no U^{235}. The existence of the U-catalyzed decomposition discourages the idea of using concentrated acid as a medium for a homogeneous nuclear reactor. (auth)

3624 ORNL-2409
Oak Ridge National Lab., Tenn.
OXIDATION OF URANIUM TETRAFLUORIDE IN A MOVING-BED REACTOR. H. W. Franz and R. H. Toye. Jan. 10, 1958. 32p. Contract W-7405-eng-26. $1.00 (OTS).

A short study was made of the oxidation of UF_4 to UF_6 with three runs in a 4-in. diam moving-bed reactor. Combustion of controlled additions of powdered C or CO was used to obtain reaction temperatures. Qualitative data indicate that UF_6 was produced during all runs. Additional experimental work will be necessary before a large-scale pilot plant can be designed and operated. (auth)

3625
THE ROLE OF LEAD AND EXCESS OXYGEN IN URANINITE. Robert M. Berman (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 42, 705-31(1957) Nov.-Dec.

An attempt is made to describe and explain the properties of uraninites in terms of their variation and composition. Analyzed samples of uraninite were x rayed, annealed by heating to 550 and 900°C for various times, and x rayed again. A decrease in unit cell size was generally observed, and calculations showed that the ordering of the interstitial oxygens could account for the decrease in cell size on annealing. A study was also made of the degree of oxidation of uraninites. Vegard's law calculations, differential leaching, and other lines of evidence indicate that Pb, including radiogenic Pb, is exsolved from uraninite. (R.V.J.)

Waste Disposal

3626 HW-53599
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
FLUCTUATIONS OF HANFORD WATER LEVELS. William H. Bierschenk. Nov. 14, 1957. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

Long-term hydrographs of water levels in 44 wells at Hanford show that water-table fluctuations are controlled primarily by the artificial recharge of aquifers by infiltrating liquid effluents, although locally some natural fluctuation is caused by alternate seepage into and from the Columbia River. In addition, the observed water level in certain wells may fluctuate due to changes in atmospheric pressure or due to earthquake shocks. Between 1944 and 1957 an estimated 4 billion cubic feet of plant effluents have saturated approximately 62 billion cubic feet of sediments. The average wetted porosity of the affected sediments is thus calculated to be about 6.4 percent. This newly-saturated zone contains essentially all the infiltrated waste water. (auth)

3627 KAPL-364(Pt. II)
Knolls Atomic Power Lab., Schenectady, N. Y.
MEETING OF THE AEC WASTE PROCESSING COMMITTEE [ON] JUNE 26-28, 1950. PART II. COPRECIPITA-

TION AS A METHOD OF WASTE DISPOSAL. J. A. Ayres, ed. Apr. 25, 1951. Changed from OFFICIAL USE ONLY Sept. 9, 1957. 35p. Contract W-31-109-Eng-52. $7.80 (ph OTS); $3.30(mf OTS).

Radioactive waste disposal following processing by co-precipitation methods was discussed. The exploratory program on carrier precipitation at KAPL is discussed in detail. Other topics discussed include the removal of Pu from laboratory wastes; phosphate flocculation for the decontamination of dilute liquid waste; laboratory coagulation experiments for the removal of activity; and biological methods such as the activated sludge process and trickling filter methods for the treatment of radioactive wastes. 11 references. (C.H.)

ENGINEERING

3628 NP-6515

Holmes and Narver, Inc., Los Angeles.

IMPACT EFFECT OF FRAGMENTS STRIKING STRUCTURAL ELEMENTS. R. A. Williamson and R. R. Alvy. [1957]. 11p.

Equations were developed which permit a designer to evaluate the impact effect of a missile striking a structural element at high velocity. Examples of the use of the equations in calculations and comparisons of the relative effect of penetration on the equivalent static design load are included. Application to calculations of structural containment for nuclear power plants is discussed briefly. (C.H.)

3629 NP-6516

Holmes and Narver, Inc., Los Angeles.

DESIGN OF PRESSURE VESSELS AND PIPING CONTAINING EXPLOSIVE MIXTURES. R. R. Alvy. [1957]. 16p.

A technique is presented for calculating structural dynamics for the design of pressure vessels and systems for use with explosive mixtures. The accuracy of the method is said to be limited only by the accuracy of information concerning the explosion characteristics of the mixture to be contained. The technique is applied to calculations for containers for hydrogen-oxygen mixtures. Illustrative design data are included for a 12-in. steel pipe and a 60-in. pressure vessel. (C.H.)

3630 NYO-3146

Hydrocarbon Research, Inc., New York.

ENGINEERING STUDY OF PLANT TO PRODUCE 1000 LITERS PER HOUR OF LIQUID 92% PARA HYDROGEN; APPENDIX A. PROCESS SPECIFICATIONS; APPENDIX B. MECHANICAL ENGINEERING DRAWINGS. Sept. 14, 1951. Decl. Feb. 27, 1957. 150p. Contract AT(30-1)-1104. $37.80(ph OTS); $11.10(mf OTS).

An engineering design study of a hydrogen liquefier capable of producing 1000 liters/hr using the low-pressure Claude process is given. The study permits the evaluation of the economics of producing liquid H_2 substantially in equilibrium between the ortho and para forms, develops the logistical problems involved in producing large amounts of liquid H_2, and permits the comparison of the low-pressure type of liquefier with other methods. Operational cost of a plant using natural gas as the source of energy and propane as the source of H is compared to plants using other sources of energy and electrolysis as the source of H. Process specifications and the mechanical engineering drawings are appended. (D.E.B.)

3631

SPRAYPAK: A NEW INDUSTRIAL DISTILLATION AND ABSORPTION TOWER PACKING. J. A. McWilliams, H. R. C. Pratt, F. R. Dell, and D. A. Jones (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. 34, 17-52(1956).

A description is given of the development of "Spraypak," a new type of industrial distillation and absorption tower packing constructed from standard $\frac{1}{8}$ in. mesh expanded metal. This packing, which is inherently self-distributing, depends for its action upon the repeated formation and coalescence of active spray by means of expanded metal surfaces which are disposed in a suitable geometric pattern. Distribution studies and measurements of pressure drop, liquid hold-up, entrainment, and flood point have been carried out with a variety of forms of the packing in a transparent rectangular column of 27 in. × 15 in. cross section with a packed height of 4 ft. The flood point data have been correlated graphically to within ±10% by the following expression:

$$\frac{L}{G}\left(\frac{\rho_g}{\rho_l}\right)^{1/2} = \varphi\left[\frac{\nu_{gf}{}^2 \rho_g s^{0.3} \gamma p^{0.25}}{\rho_l h}\right].$$

where φ is a graphical function, ν_{gf} represents the flood point, and s, p, and h are characteristics of the packing. H.E.T.P. tests have been carried out in a mild steel distillation unit with a column of the same cross-section and a packed height of 20 ft. Runs were carried out on the more favorable forms of the packing, as determined from the air-water tests, using the heavy water–light water system, and, in a few cases, the benzene-carbon tetrachloride system. The H.E.T.P. values for No. 37 type Spraypak, which is found to be close to the optimum form for normal distillation purposes, ranged from 1.25 ft at the flood point to 2.0 ft at 60% of flooding with the water system. Flood-point measurements were also carried out under distillation conditions and the results were in good agreement with the above correlation. The packing was found to be completely stable in operation at or above the flood point, the only effect of flooding being an increase in entrainment of liquid from the top of the column. The results indicated that the throughput of the packing at the flood point is some 150 to 200% greater than that of the best design of bubble plate column with a tray spacing of 1.5 ft. Taking into account the improvement in H.E.T.P. in the range 70 to 100% of flooding, a reduction in effective tower volume of some 50 to 60% can be achieved, as compared with that of a conventional bubble-tray column. This leads to appreciable savings in cost of both column shell and filling. (auth)

Heat Transfer and Fluid Flow

3632 NDA-29

Nuclear Development Corp. of America, White Plains, N. Y.

REACTOR HEAT TRANSFER PROGRESS. [Issue] No. 11. Unclassified Section. (15J-15). John E. Viscardi, ed. Includes translation of article continued from NDA-28: CHARACTERISTICS OF MERCURY BOILING IN THE TUBES OF A MERCURY-VAPOR GENERATOR. A. N. Loshkin and P. I. Krol'. Translated by John E. Viscardi from Zhur. Tekh. Fiz. 8, 1872-81(1938). 22p. Contract AT(30-1)-862. $4.80(ph OTS); $2.70(mf OTS).

There is no Classified Section of Issue No. 11.

Papers scheduled for presentation at the Reactor Heat Transfer Conference, Nov., 1956, in New York are listed. Abstracts of a number of these papers are included. Results from burnout tests with 2000 psia water flowing upward in a rectangular Zircaloy tube are given. (For preceding period see NDA-28.) (D.E.B.)

3633 NP-6508

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

WETTING EFFECTS ON HEAT TRANSFER. Final Report [for] September 1, 1955 through September 30, 1957 [on] Project No. A-252. W. B. Harrison. 131p. DA Project No. 5B99-01 Contract DA-01-009-ORD-444.

The first chapter deals with the general considerations involved in bubble formation and wetting effects. Specific problems related to the copper–stearic acid system also are discussed as background material pertaining to the boiling heat transfer studies described in the second and third chapters. Wetting effects on convective heat transfer are studied with a copper–stearic acid system, reported in the fourth chapter, and a copper–sodium system, reported in the fifth chapter. These convective studies were each made in experimental apparatus which incorporated a region so as to maximize the effect of additional thermal resistance created by nonwetting conditions at the heat transfer surface. In general, the work demonstrated a significant wetting effect on boiling stearic acid from different faces of copper single crystals, but wetting effects were not observed with stearic acid in forced convection past the same crystal surfaces without boiling. The convective studies with sodium were inconclusive, but they leave open the possibility that low and erratic data may be due to nonwetting conditions at the heat transfer surface. (A.C.)

3634 NRL-4990

Naval Research Lab., Washington, D. C.

HEAT-TRANSFER STUDIES ON A FORCED CONVECTION LOOP WITH BIPHENYL AND BIPHENYL POLYMERS. C. T. Ewing, J. P. Stone, C. H. Blachly, B. E. Walker, and R. R. Miller. July 16, 1957. 34p.

The pumped loop at NRL is designed to study heat transfer characteristics of organic fluids and the effect of pyrolytic decomposition products on heat transfer surfaces. The studies are based on the direct determination of film coefficients, over-all heat transfer coefficients, or both, on an electrically heated horizontal tube. Reliable film coefficients in the high turbulent region for biphenyl and two polymer-biphenyl mixtures (25% and 40% polymer) are presented and effectively correlated with an equation of the Dittus-Boelter type. Data showing a lack of fouling at surface temperatures of 850°F are presented for short term experiments with biphenyl and a low-polymer mixture (25% polymer). Plugging in gage and drain lines during loop operation, resulting from low solubility of paraquaterphenyl and/or higher parapolyphenyls, is discussed. Associated with the loop studies, physical properties for a number of phenyl compounds and mixtures were determined. Density and viscosity values are reported for biphenyl, metaterphenyl, paraterphenyl, monoisopropylbiphenyl, and two polymer-biphenyl mixtures. Equations are presented for extrapolation of the data to higher temperatures. Also, solubility values are reported for a number of phenyl compounds in biphenyl and other aromatic solvents. (auth)

3635 WAPD-FE-175

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURE DROP THROUGH A ROTATED PLATE SUBASSEMBLY. R. A. DeBortoli. June 23, 1954. Decl. Mar. 19, 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

Pressure drop for various aqueous flow rates through a rotated plate fuel element type of subassembly was measured. (T.R.H.)

3636 WAPD-TH-333

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PRELIMINARY INVESTIGATION OF EXTERNAL QUENCHING OF A PLATE-TYPE SUBASSEMBLY FROM AN INITIAL STEADY STATE CONDITION. R. A. DeBortoli and J. S. Williams, Jr. July 9, 1957. 31p. $4.80(ph OTS); $2.70(mf OTS).

A series of tests was conducted to determine the effect of a sour sided external quench on a plate type Zr subassembly after it had been electrically heated in air to a steady state temperature. The maximum steady state temperatures prior to the quenching were approximately 1000, 1250, 1500, 1750, and 2100°F. The applied electrical power was maintained at approximately the steady state value while the quench was performed. Temperature time traces of various locations in the subassembly are presented. The results indicate that the outer plate temperatures decrease rapidly (2 to 3 sec) to a temperature level predicted by the Jens and Lottes local boiling correlation. The time was not a strong function of the initial temperature level. The effect of this quench penetrates to the center of the subassembly in 15 to 30 sec depending on the initial temperature level. Due to thermal shock, considerable distortion was evident which was cumulative over the series of runs. Measurements of this are included. Observations of corrosion on the quenched surface are also presented. The corrosion became evident after the 1500°F run and increased in severity until after the 2100°F run a thick white corrosion layer was present. (auth)

3637

RISING PLANE BUBBLES. Garrett Birkhoff and David Carter (Los Alamos Scientific Lab., N. Mex.). J. Rational Mech. and Anal. 6, 769-80(1957) Nov.

Materials Testing

Refer also to abstract 3601.

3638 AECD-3764

Du Pont de Nemours (E. I.) & Co. Explosives Dept., Wilmington, Del.

NEOPRENE AND NICKEL LININGS. NYX Test No. 1.3.4. Fred J. Poss and Bruce Longtin. Dec. 1952. 42p. Contract AT(07-2)-1. (DPXN-211). $7.80(ph OTS); $3.30 (mf OTS).

Stainless steel valves, pumps, and heat exchangers were not available for NYX start-up. Cast iron and steel equipment was protected against corrosion by lining with neoprene and nickel plate. The linings failed under flow conditions and their use was discontinued. Chromate inhibitor was used to reduce rusting for the remainder of the test program. (auth)

3639 AERE-R/R-1891

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME PRELIMINARY TESTS ON BEARING MATERIALS TO OPERATE UNDER LIQUID SODIUM–REVISED INTERIM REPORT–JUNE 1954. D. F. Elliott, E. Holland, and K. A. Tomblin. Apr. 23, 1956. Decl. Sept. 17, 1957. 37p.

The object of these tests is to determine the most suitable materials to be used in the construction of bearings for a 50 H.P. Sodium Pump. The most critical period of operation for these bearings is during start up, when a condition of 'boundary lubrication' will exist, and metal-to-metal contact will occur between the rotating shaft and the bearing until the speed of the pump shaft is sufficient to give true 'hydrodynamic lubrication' by creating a continuous film of sodium within the bearing. The characteristics required for a suitable pair of bearing materials are given. The results of these tests may also be useful

in the selection of materials for use as rubbing surfaces in reactor mechanisms which are required to operate submerged in liquid Na or Na–K alloy. (auth)

3640 CF-57-11-111
Oak Ridge National Lab., Tenn.
STRESS ANALYSIS OF FLAT CIRCULAR PLATES. F. J. Stanek. Nov. 25, 1957. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The principal relations for the stress analysis of flat circular plates according to the classical theory are presented in a convenient form. Almost any flat circular plate of uniform thickness, with or without central holes, loaded with any combination of axisymmetrical loads may be analyzed by the procedures. (A.C.)

3641 CF-57-12-72
Oak Ridge National Lab., Tenn.
EVALUATION OF CHECK VALVE MATERIALS IN URANYL SULFATE AND IN DISTILLED WATER. R. Blumberg. Dec. 17, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Tests were made on a variety of materials in order to improve the durability of valves in the HRT. As a result of these tests and examination of prior experience, the following recommendations were made: Stainless steel type PH 17-4 for check valve seat material in water service; Stellite No. 3 for check valve seats in fuel service; Stellite Star "J" balls used throughout. In addition, stainless type 347, Carpenter "20," aluminum oxide and Kennametal K-501 were tested in fuel and water. (auth)

3642 HW-51979
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ULTRASONIC DETECTION OF SURFACE DEFECTS IN URANIUM. C. E. Fitch, Jr. Sept. 3, 1957. Decl. Dec. 13, 1957. 27p. Contract W-31-109-Eng-52. $1.00(OTS).

An ultrasonic test is described that is capable of detecting seams and striations as small as one to two mils in depth in bare uranium fuel element surfaces. The test can segregate cores by a counting method which is a function of defect depth and integrated length. (auth)

3643 ITR-1475
Harvard Univ., Boston. Air Cleaning Lab.
BLAST EFFECTS ON AN AIR-CLEANING SYSTEM. Preliminary Report. Richard Dennis and C. E. Billings. Sept. 1957. 49p. Project 34.4 [of] OPERATION PLUMBBOB. $1.50(OTS).

A study was made on the effect of shock waves on various types of air cleaning equipment. Shock waves generated by nuclear or high-explosive blasts which impact upon air-cleaning devices in a direction opposite to that of normal air flow were investigated. Major blast effects studied include destruction or damage to air-cleaning equipment designed to collect radioactive materials, and dislodgement and subsequent resuspension in air of radioactive dust from collector surfaces by the reverse air flow produced by the blast. Data are included from laboratory and field tests. (C.H.)

3644 KAPL-M-EDL-75
Knolls Atomic Power Lab., Schenectady, N. Y.
MARK A CONTROL ACTUATOR SHAFT FREEZE-SEAL. P. W. Bissonnette and R. D. Vallee. Sept. 1, 1954. Decl. Mar. 13, 1957. 26p. Contract W-31-109-Eng-52. $4.80 (ph OTS); $2.70(mf OTS).

Investigations were conducted to determine the mechanical properties of Na sheared in a narrow annulus at controlled temperature gradients and shear velocities. The test fixture consisted of a 1 in. diameter stainless-steel shaft centered in a 1.099 in. ID Type-304 stainless-steel tube. Sodium shear values were found to be dependent upon the temperature and shear velocity at a given test condition. Sodium shear values obtained were found to be consistent, wherever wetting of components had been assured by contact with hot Na at temperatures above 500°F for periods of one-half hour or greater. Tests conducted showed Na shear to have occurred internally, rather than at freeze-seal interfaces within the range of shaft velocities tested. The apparent shear strength of Na was found to fall off rapidly with successive shearing cycles to steady-state values corresponding to particular shearing velocities. Tests showed that with the freeze-seal at rest, a healing action occurred as a function of time, resulting in substantially complete regaining of initial shear strength. (auth)

3645 NP-6507
Grumman Aircraft Engineering Corp., Bethpage, N. Y.
SEAPLANE HULL BOTTOM NEUTRON ACTIVATION STUDY. Bi-Monthly Progress Report No. 2. M. Zizza and M. D'Agostino. Sept. 1957. 10p. Contract NOas-57-622. (RE-86-PR-2).

Small specimens of typical hull bottom construction materials were exposed to a predominantly fast neutron flux. Modifications made in the design of equipment for the irradiation studies are described. Information required for the IBM-650 computation of the specimen activities was assembled and programmed. Brookhaven Reactor fluxes were recalibrated. (For preceding period see NP-6438.) (C.H.)

3646 RAE-TN-CHEM-1291
Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.
THE EFFECT OF PRELOADING UNDER VARIOUS ENVIRONMENTAL CONDITIONS ON THE STRENGTH OF GLASS-FIBRE LAMINATED PLASTICS. M. M. Cornford and W. W. Wright. Nov. 1956. 35p.

The flexural strength of glass-fiber laminated plastics was determined after preloading under conditions of elevated temperature, high humidity, or both. The strength depended on the types of resin and glass cloth, and on the treatment applied to the glass cloth. An epoxy resin was superior to the other resins tested. High alkali glass-cloth polyester laminates were less affected than were similar low alkali glass-cloth laminates, but the latter possessed greater flexural strength. The use of vinyl trichlorosilane treated cloth resulted in improved strength figures with polyester, epoxy and phenolic resins as compared with other treated cloths. It is recommended that when low alkali glass-cloth polyester laminates may be subjected to elevated temperature and humidity they should not be stressed beyond one-sixth of their ultimate strength. A combination of an epoxy resin with a low alkali glass cloth treated with vinyl trichlorosilane gave laminates having properties markedly superior to those of the other resin-glass cloth combinations tested. (auth)

3647 WADC-TR-56-227
Michigan. Univ., Ann Arbor. Engineering Research Inst.
AN EXPERIMENTAL STUDY RELATING TO THE PREDICTION OF ELEVATED-TEMPERATURE STRUCTURAL BEHAVIOR FROM THE RESULTS OF TESTS AT ROOM TEMPERATURE. Harold F. Allen. Apr. 1956. 47p. Project title: STRUCTURAL TESTING AT ELEVATED TEMPERATURES. Task title: STRUCTURAL TESTING CRITERIA. Contract AF33(616)-2437. (AD-97344).

Some 24-ST aluminum alloy box beams were structurally tested at temperatures from 75 to 700°F. The tests indicate the possibility of development of an empiri-

cal method for estimating ultimate strength, safe life, and maximum permissible load in aircraft structures. (T.R.H.)

3648 WADC-TR-56-230
Forest Products Lab., Madison, Wis.
PERFORMANCE OF SANDWICH WITH CORES OF FOAMED SILICONE AND MODIFIED POLYESTER RESINS AT ELEVATED TEMPERATURES AND AT HIGH HUMIDITY. [Period covered] July 1954 to April 1956. V. C. Setterholm and E. W. Kuenzi. June 6, 1956. 29p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SANDWICH CONSTRUCTION. Contract AF33(616)-56-9. (AD-110421).

Compression, tension, and shear properties of plastic sandwich with foamed-in-place cores were determined at temperatures from 75 to 700°F. Cores were of Dow Corning silicone foam R-7002, with a density range of 12.6 to 17.5 lb/ft^3, and triallylcyanurate modified polyester resin (Laminac 4231) reacted with 2,4-toluene diisocyanate, with a density range of 11.9 to 12.2 lb/ft^3. Also presented are data on the weight and dimensional stability of silicone and Laminac 4231 cores exposed to 100% relative humidity at 100°F for 21 days. The strength tests show that Laminac 4231 cores are much stronger than silicone cores of the same density at temperatures below 300°F. Above 300°F., the strength of Laminac 4231 cores approaches the strength of silicone cores. The weight and dimensional stability of silicone cores were not affected by exposure to high humidity. Laminac 4231 cores showed increases in both weight and dimension after the high-humidity exposure. (auth)

3649 WADC-TR-56-272
Boeing Airplane Co., Seattle.
DESIGN DATA FOR O-RINGS AND SIMILAR ELASTIC SEALS. [Period covered] July 1955 to April 1956. Frank W. Tipton. May 1956. 110p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: COMPOUNDING OF ELASTOMERS. Contract AF33(616)-2867. (AD-110598).

In order to fully utilize materials for seal design, a knowledge of the relationship between the physical properties of the materials and sealing efficiency is required. This report includes a literature survey on O-rings and seal design and functional tests of O-rings prepared from rubber compounded to have various physical properties. No definite relationship between seal life and physical properties was found. The inability of the O-ring to maintain sufficient internal pressure and to withstand mechanical conditions are believed to be the two reasons for seal failure. (auth)

3650 WAPD-AD(V)-662
Crane Co., Chicago.
CRANE COMPANY SEAL LEAKAGE PROGRAM. F. J. Hartz. Jan. 31, 1955. Changed from OFFICIAL USE ONLY Dec. 9, 1957. 11p. For Westinghouse Electric Corp. Atomic Power Div. Contract AT-11-1-GEN-14. Subcontract 73(14-349). $3.30(ph OTS); $2.40(mf OTS).

A program was initiated to compile test data on conventional sealing materials and to investigate methods of operating valves wherein forces must be transmitted through a pressure wall. Test results, descriptions of apparatus and measuring techniques, and conclusions and recommendations are included. (D.E.B.)

3651 WAPD-LSR(RD)-210
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
RING SPRING CHARACTERISTICS. W. W. Wise. Oct. 6, 1955. Changed from OFFICIAL USE ONLY Oct. 2, 1957. 22p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70 (mf OTS).

The fundamental characteristics of ring springs are established so as to facilitate their applicability in the mechanical design of nuclear reactors. (L.T.W.)

Pumps

3652 AERE-R/M-144
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
DESIGN OF TRAVELLING FIELD INDUCTION PUMPS FOR LIQUID METALS. D. A. Watt. Sept. 1957. 13p.

Theory and examples of design for maximum rate of pressure rise are given. It is shown that while designs for low resistivity, low density liquid metals optimized do not give the maximum possible rate of head rise the condition for this is not greatly different. A technique for rapidly deriving the condition for maximum rate of head rise is illustrated and the basic principles discussed. For high resistivity liquid metals it is explained that an approach limiting flow speed and gap flux density would be needed, although performance is inevitably reduced and the D.C. pump offers a much better power rating and efficiency. (auth)

3653 ORNL-2168
Oak Ridge National Lab., Tenn.
COMPATIBILITY OF PUMP LUBRICANTS WITH ALKALI METALS AND MOLTEN FLUORIDE SALTS. G. Goldberg, A. S. Meyer, Jr., and J. C. White. Jan. 11, 1957. Decl. Sept. 18, 1957. 16p. Contract W-7405-eng-26. $3.30 (ph OTS); $2.40(mf OTS).

This report includes a description of an apparatus and a detailed procedure for testing the compatibility of pump lubricants with alkali metals and molten fluoride salts. Results are given for the reaction between certain pump lubricants at 200°F and molten sodium metal and molten fluoride salts at 1100°F. (auth)

3654
GLASS CIRCULATING PUMP FOR OBTAINING NOBLE GASES OF HIGH PURITY. W. R. Bennett, Jr. (Columbia Univ., New York). Rev. Sci. Instr. 28, 1092-3(1957) Dec.

Waste Disposal

3655 AECU-3602
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RADIOACTIVE WASTE DISPOSAL SYSTEM. J. R. LaPointe. July 24, 1957. 9p. Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30(mf OTS).

Seven illustrations are given for convenience in developing operating procedures for disposal of PWR wastes. The illustrations include radioactive waste disposal systems for service building wastes, liquid effluents, solid and gaseous wastes, cooling water, steam system, and miscellaneous service lines. (J.E.D.)

MINERALOGY, METALLURGY, AND CERAMICS

Corrosion

3656 AECU-3597
Case Inst. of Tech., Cleveland.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT

ELEVATED TEMPERATURES. Quarterly Status Report No. 18 [for] September 2, 1957 to December 2, 1957. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Dec. 9, 1957. 11p. Contract AT(11-1)-258. $3.30(ph OTS); $2.40(mf OTS).

The effect of gas penetration on the scaling behavior of iodide zirconium in air at 900°C was studied. (For preceding period see AECU-3567.) (T.R.H.)

3657 HW-33736

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE USE OF MINUTE AMOUNTS OF SODIUM DICHROMATE AS A CORROSION INHIBITOR IN SINGLE PASS ALUMINUM SYSTEMS. D. R. DeHalas. Nov. 11, 1954. Decl. Jan. 7, 1958. 36p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00(mf OTS).

Sodium chromate can be used effectively as a corrosion inhibitor for Al systems in concentrations as low as 0.1 ppm. The mechanism by which the chromate protects Al was also investigated. (C.W.H.)

3658 WAPD-CDA-(1)-3

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

CHEMISTRY OF THE NINTH PWR FUEL MATERIAL TEST X-1 LOOP NRX REACTOR. Interim Report covering period from start-up, January 18 to April 8, 1957. R. Ehrenreich. 37p. $6.30(ph OTS); $3.00(mf OTS).

The ninth PWR Fuel Material test in the X-1 loop of the NRX reactor is a long term proof test for Zircaloy-2 clad UO_2 fuel specimens under irradiation at PWR reference conditions. One of the fuel specimens was fabricated with a cladding defect. The test is scheduled to run for a period of one year and achieve a fuel burn up of 10,000 Mwd/ton of UO_2. Radiochemical analyses have been performed on loop water, purification resins and loop piping. The results up to and including the reactor shutdown after 80 days are presented. The progress of the test has been satisfactory to date with the exception of short periods of abnormally low levels of radionuclide activity. The fission product activity in the coolant during these low levels is what would be expected from uranium contamination. Consequently, it appears that the defect becomes plugged in some manner. (auth)

3659 Y-B32-88

Oak Ridge National Lab., [Y-12 Area], Tenn.

CHANGES IN MELTING POINT OF FLUORIDES DURING CORROSION TESTS. G. J. Nessle and C. J. Barton. Feb. 12, 1952. Decl. July 5, 1957. 3p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

Tests were made with selected specimens which had been exposed in static corrosion capsules for 100 hr at 800°C and with specimens from dynamic corrosion loops which had operated until plugging occurred. Results indicate that the plug is composed of high melting material containing the structural metals, either free or in chemical combination, but the fluoride mixture had not changed in melting point during the corrosion test. (L.T.W.)

3660

THE OXIDATION OF MOLYBDENUM. E. S. Jones (General Electric Co., Cincinnati, Ohio); J. F. Mosher (Wright-Patterson Air Force Base, Ohio); and Rudolph Speiser and J. W. Spretnak (Ohio State Univ., Columbus). Corrosion 14, 2t-8t(1958) Jan.

Scale formed upon molybdenum consists of either two or three oxide layers, depending upon temperature and time. The outermost layer is the volatile MoO_3. The inner layers of oxide have a composition very close to MoO_2 but do not exhibit an x-ray pattern corresponding to MoO_2. The rate of evaporation of MoO_3 and the mechanism of molybdenum oxidation were determined. It was found that after an initial parabolic dependence of weight change upon time the rate of oxidation became linear. This is due to the fact that the outer MoO_3 layer is non-protective so that the rate of oxidation of the suboxide to the trioxide at the suboxide-trioxide interface is equal to the rate of diffusion of oxygen through the suboxide film to the metal-suboxide interface. It was also found that the presence of liquid MoO_3 increased the rate of oxidation of molybdenum. (auth)

3661

BREAKAWAY OXIDATION OF ZIRCONIUM–TIN ALLOYS. Earl A. Gulbransen (Westinghouse Research Lab., Pittsburgh) and Kenneth F. Andrew. Corrosion 14, 32t, 34t-5t (1958) Jan.

A breakaway oxidation reaction is found for zirconium-tin alloys similar to the breakaway corrosion reaction found for steam reactions. As oxidation is a simple reaction to study, the basic breakaway phenomena may be elucidated. Data are given to show the breakaway oxidation of Zircaloy II at temperatures from 600 to 800°C. (auth)

3662

CORROSION AND METAL TRANSPORT IN FUSED SODIUM HYDROXIDE. PART 3. FORMATION OF COMPOSITE SCALES ON INCONEL. G. Pedro Smith, Mark E. Steidlitz, and Eugene E. Hoffman (Oak Ridge National Lab., Tenn.). Corrosion 14, 47t-52t(1958) Jan.

Inconel was exposed to fused NaOH at temperatures of 450 to 815°C and for times up to 400 hr. The observed reaction was shown to consist in the selective leaching of Fe and Cr from their solid solution with Ni. The reaction product, a mixture of oxides and sodium oxysalts, was found to grow in a network of channels which, starting from the metal surface, penetrated into the bulk Inconel. The geometry of this network differed considerably with different experimental conditions and is described in detail. Rate measurements were made and the results reported. (auth)

3663

STRUCTURAL FEATURES OF CORROSION OF ALUMINUM ALLOYS IN WATER AT 300°C. Kurt M. Carlsen (E. I. du Pont de Nemours and Co., Wilmington, Del.). Corrosion 14, 53t-6t(1958) Jan.

A number of aluminum alloy specimens were immersed in distilled water heated to 300°C and a study made of the structural features of corrosion. Samples were on the following general types: Al–Ni alloys, Al–Fe alloys, Al–Ni–Fe alloys, Al–Cu alloys and Al–Ni–Si alloys. After exposure samples were examined by means of a metallographic microscope. In a number of cases the specimens were ground on a metallographic polishing wheel to reveal structural details of the corrosion process. Photomicrographs of both polished and unpolished specimens are included with the paper. (auth)

Geology and Mineralogy

3664

THREE OCCURRENCES OF HIGH-THORIAN URANINITE NEAR EASTON, PENNSYLVANIA. Arthur Montgomery (Lafayette Coll., Easton, Penna.). Am. Mineralogist 42, 804-20(1957) Nov.-Dec.

The geology, mineralogy, and paragenesis of three occurrences of high-thorian uraninite in serpentine near Easton, Penna., are described. Seven x-ray fluorescence analyses and three chemical analyses revealed this mineral to be high-thorian uraninite rather than high-

uranoan thorianite as had been supposed. Six samples contained 15 to 35% ThO_2. It was pointed out that Th rich Easton uraninites do not alter readily to secondary minerals, except when subjected to severe deformation and concomitant attack by serpentinizing hydrothermal solutions. (R.V.J.)

3665

COLLAPSE FEATURES, TEMPLE MOUNTAIN URANIUM AREA, UTAH. Paul F. Kerr, Marc W. Bodine, Jr., Dana R. Kelley, and W. Scott Keys. Bull. Geol. Soc. Amer. 68, 933-81(1957).

Hydrothermal solutions mainly of hypogene origin are believed to be responsible for the formation of collapse features, their associated alteration effects, and the accompanying mineralization at and near Temple Mountain, Utah. The collapse features are characterized by: (1) a central core, consisting of blocks and fragments of downdropped broken strata; (2) a structural basin in surrounding strata; (3) marked alteration effects which differ in core and border. The collapse features, 11 of which are noted, range from less than 100 ft in diameter to more than 1000 ft and with three exceptions consist of a Moss Back core in Moenkopi country rock. Even the three exceptions represent a similar process. The writers believe that the collapse structures were formed by the removal of the underlying carbonate rocks (Kaibab Limestone and lower and middle Moenkopi Formation), which resulted in downdropping of the higher strata and sagging of the surrounding beds to form the enclosing basin. At the Temple Mountain collapse Wingate and Moss Back sandstone blocks have been dropped several hundreds of feet and are enclosed in structural basins of Moenkopi and Chinle strata. Drilling records reveal that the carbonate constituents of the underlying Kaibab Limestone have been removed. Alteration effects within the collapsed core and the surrounding country rock from the top of the Coconino Sandstone through the Wingate Sandstone include argillization, carbonatization (dolomitization), and ferrugination (sideritization and hematitization); the uranium mineralization following consists chiefly of emplacement of pyrite, urano-organic ore, and late alteration effects, chiefly alunitization. Mineral relationships indicate that hydrothermal solutions dominated in processes of the development of the collapse features and in the alteration and mineralization. (auth)

3666

MINERALOGY, PETROGRAPHY, AND RADIOACTIVITY OF REPRESENTATIVE SAMPLES OF CHATTANOOGA SHALE. Thomas F. Bates and Erwin O. Strahl. Bull. Geol. Soc. Amer. 68, 1305-13(1957).

Qualitative and quantitative mineralogical studies of the Chattanooga Shale are in progress. Problems of separation and analysis of mineral and organic components are difficult because the rock is fine-grained. However, the application of light and electron microscopy, x-ray diffraction, nuclear-track study, and other methods has provided data of interest. Megascopically, the shale is a massive chocolate-brown sediment which displays faint indications of lamination. Some pyrite lenses, nodules, and crystals and a few mica flakes are large enough to be seen with a hand lens. In thin section the rock is seen to consist of grains of quartz and feldspar in a matrix of yellow to red-brown organic material, which incorporates shreds of mica and probably clay particles and is dotted by small clusters of pyrite. Larger organic fragments with associated pyrite are common and take various forms. Individual mineral particles range from pyrite cubes less than 0.15 micron on a side to quartz and feldspar grains as large as 0.10 mm. X-ray studies show the clay minerals to be illite, kaolinite, and chlorite in decreasing order of abundance. Tourmaline, zircon, and apatite are the characteristic heavy minerals of the sediment. Quantitative studies, accomplished by a combination of chemical and mineralogical methods, have shown the composition of a batch sample of this rock to be approximately: 22% quartz, 9% feldspar, 31% illite and kaolinite, 22% organic matter, 11% pyrite and marcasite, 2% chlorite, 2% iron oxides, and 1% tourmaline, zircon, and apatite. Alpha-track studies of emulsion-covered thin sections indicate that no uranium mineral is present. Approximately 70% of the uranium atoms is randomly distributed throughout the fine-grained matrix of the rock, whereas another 25% is concentrated in organic-pyrite-clay complexes such as pyrite nodules and discrete organic bodies. In unweathered samples there is no relationship between uranium distribution and textural features such as bedding. The data indicate that the uranium was precipitated from sea water under reducing conditions and has not been redistributed following compaction of the sediment. (auth)

3667

THE PRESENCE OF A URANIFEROUS MINERALIZATION IN TWO QUARRIES OF THE VIGNEUX REGION (LOIRE-ATLANTIC). René Coppens and Hussien Abdel Mohsen Hussein. Compt. rend. 245, 1818-20(1957) Nov. 18. (In French)

3668

THE USE OF LEACHABLE URANIUM IN GEOCHEMICAL PROSPECTING ON THE COLORADO PLATEAU. I. THE DISTRIBUTION OF LEACHABLE URANIUM IN CORE SAMPLES ADJACENT TO THE HOMESTAKE ORE BODY, BIG INDIAN WASH, SAN JUAN COUNTY, UTAH. Heinrich D. Holland, Betty Ruth Curtiss, George E. McGill, and John A. Petersen. Econ. Geol. 52, 546-69(1957) Aug.

Data on the concentration of leachable uranium, total uranium, beta-gamma activity, alpha activity, and petrography are presented for core samples from the vicinity of the Homestake ore body, Big Indian Wash, San Juan County, Utah. It is shown that the leachable uranium content in such cores is generally highest in the vicinity of the Chinle-Cutler contact, and that the contours of leachable uranium for this horizon outline satisfactorily the Homestake ore body and an east-west trending belt of mineralization including the Homestake and the Standard-Caluranium ore bodies. This trend is defined more precisely by data on the leachable uranium concentration than by the beta-gamma activity of the samples studied, and it is concluded that leachable uranium analyses may serve as a useful tool in exploration for uranium ore. (auth)

3669

GEOLOGY OF THE DAKOTA FORMATION URANINITE DEPOSIT NEAR MORRISON, COLORADO. E. H. Goldstein. Econ. Geol. 52, 775-85(1957) Nov.

Several significant uranium discoveries have been made since 1953 along the front range of Colorado. Uranium ore has been found both in Precambrian rocks and sedimentary rocks. The Precambrian rocks consist of metasediments and intrusive batholithic granites. The sediments range from Pennsylvanian to Tertiary in age. Uranium ore is found in the upper (Muddy) sandstone member of the Dakota formation in close association with asphalt, pyrite, and ilsmenite (molybdenum oxide) and is controlled by a west dipping strike-slip fault. The ore body occupies a position adjacent to and in the footwall side of the fault, and traces of uranium are found on the hanging wall side. Uranium is also found in the lower sandy portion of the Dakota shale. The uraninite is believed to be a primary ore of hydrothermal origin. It is further suggested that uranium-bearing hydrothermal solutions originated in the Precambrian complex and migrated eastward along the Golden thrust fault. The Golden thrust fault, which underlies the

area, therefore served as a conduit for the solutions. The solutions then migrated into minor shear zones that intersect the main Golden thrust fault, and where these minor faults traversed permeable sandstone, the solutions impregnated the sandstone. Uranium was then precipitated from the hydrothermal solutions when favorable conditions for deposition, such as asphaltum, were encountered. (auth)

3670

A NEW METHOD FOR OBTAINING SIGNIFICANT AVERAGE DIRECTIONAL MEASUREMENTS IN CROSS-STRATIFICATION STUDIES. O. B. Raup and A. T. Miesch (Geological Survey). J. Sediment. Petrol. 27, 313-21 (1957) Sept.

A new method is described that can be used conveniently in the field to determine the number of measurements of cross-strata dip directions necessary to obtain a significant average direction for an area. The method commonly used in the past has involved a great deal of graphical computation in the field. The suggested method is based on the fact that the number of measurements needed is approximately proportional to their variation. The estimated standard deviation of the first 50 measurements is determined, and, by simple linear regression equation, the number of measurements needed is computed. This regression equation has a standard error of plus or minus 18 measurements. If 36 measurements are taken in addition to the number indicated by the equation, the geologist can be about 95% confident he has enough measurements to compute an average dip direction that will be comparable to that which would be obtained with the standard cumulative vector direction curve method. With the suggested method confidence intervals for the average directions can be obtained easily. A brief discussion of the application of Stein's two-stage sampling method to cross-stratification studies is also given. Stein's method is applicable to the case where an average direction must be within previously specified confidence limits. (auth)

3671

URANIUM PRODUCTION IN THE UNITED STATES. Jesse C. Johnson (U. S. Atomic Energy Commission, Washington). Uranium 4, No. 10, 8-14, 34-6(1957) Nov.-Dec.

3672

PLUM URANIUM CONCENTRATOR EXPLAINED IN FLOWSHEET. Uranium 4, No. 10, 38-9(1957) Nov.-Dec.

A brief report is presented on the Plum process for concentrating and upgrading U ores, including the system developed at the Shawano Development Co. Mine. A flowsheet showing how the concentrating system is set up with an explanation of how the reaction takes place is presented. (J.E.D.)

3673

RECONNAISSANCE FOR URANIUM IN ASPHALT-BEARING ROCKS IN THE WESTERN UNITED STATES. W. J. Hail, Jr. U. S. Geol. Survey Bull. 1046-E. 1957. 35p. Available from U. S. Government Printing Office for $0.20.

An appraisal of asphalt-bearing rocks as potential sources of uranium was made during 1953 and 1954 in 45 areas in Calif., Utah, Wyo., Mont., N. Mex., Tex., Okla., and Mo. A total of 202 samples from these areas was analyzed for uranium. The oldest rocks sampled are Ordovician in age, and the youngest are Recent. Although none of the deposits are of value at this time as a source of U, some of the deposits may constitute a low-grade U resource, but recovery of the U will depend upon the primary use of the asphalt. Significant amounts of U in the ash of oil extracted from these rocks were found in samples from 7 of the 45 areas examined. These areas are Chalone Creek, McKittrick, Edna, and Los Alamos, Calif.; Vernal, Utah; Sulphur, Okla.; and Ellis, Mo. The average U content in the ash of the extracted oil of samples from these 7 areas ranges from 0.028 to 0.376%. All except the Chalone Creek area contain large estimated reserves of asphalt-bearing rock, ranging from 15 million to almost 2 billion tons. The average U content of samples from 13 additional areas ranges from 0.020 to 0.068% in the ash of the extracted oil. Many of these areas contain very large reserves of asphalt-bearing rocks. It is believed that most of the asphalt deposits are oil residues, and that the U was introduced during or after the late stages of oil movement and loss of the lighter oil fractions. (auth)

3674

NOTES ON THE GEOLOGY OF URANIUM. M. R. Klepper and D. G. Wyant. U. S. Geol. Survey Bull. 1046-F. 1957. 65p. Available from U. S. Government Printing Office for $0.25.

The report attempts to synthesize this great volume of diverse information and to point out features that may be important in searching for and appraising uranium deposits. The report deals with processes that concentrate uranium; describes types of uranium deposits; and discusses the clustering of uranium deposits within provinces, and provides some clues for prospecting and appraisal. (auth)

Metals and Metallurgy

Refer also to abstract 3961.

3675 AERE-M/M-25

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ELECTROLYTIC POLISHING AND ETCHING OF URANIUM. B. W. Mott and H. R. Haines. Dec. 27, 1950. Decl. June 28, 1957. 8p.

The methods used for the electrolytic preparation of uranium sections for microscopical examination and for examination of the grain size are reviewed. Four electrolytes are recommended for polishing and four for etching to reveal the grain size. (auth)

3676 AERE-M/R-721

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

INTERDIFFUSION BEHAVIOUR OF COPPER AND URANIUM. I. J. Bear and A. D. Le Claire. June 6, 1951. Decl. July 4, 1957. 17p.

This report sets out a method for measuring the rates of interdiffusion of Cu and U and details the results obtained by the method. The technique is one applicable to a study of the interdiffusion of any two metals with small ranges of solubility in each other. Preliminary experiments were designed to obtain good cohesion between Cu and U. Of these, the methods of electroplating and hot rolling gave poor results, but that of hot pressing U powder on to Cu discs at 760°C and under a pressure of 10 tons/sq. in. proved to be very satisfactory. Diffusion anneals were carried out in vacuum at various temperatures and the rates of diffusion determined by measuring the rate of advance of the phase boundary into each metal together with the rate of increase in the total width of the diffusion band. Subsidiary observations of the phases present in the U-Cu system indicated that besides the elements themselves there are at least two other primary phases present in the system at the temperatures employed in the diffusion anneals. (auth)

3677 AD-130129
Syracuse Univ., N. Y. Metallurgical Research Labs.
NOTCH SENSITIVITY OF TITANIUM ALLOY SHEETS. Quarterly Progress Report No. 1 [for] Period February 1 to May 1, 1957. G. Sachs, R. F. Pray, and T. H. Yeh. May 1957. 7p. Contract NOas-57-483-d. (MET-481-575PRI).

No testing has yet been undertaken on the project. A literature survey is in progress. Little data are available on titanium alloys at high temperatures, particularly in notch condition. Data on notched flat specimens of other materials such as steels and various aluminum alloys are very incomplete. However, from these scattered results it is known that there is a notch effect in this type material. (A.C.)

3678 BM-RI-5365
Bureau of Mines.
THE TITANIUM–GERMANIUM SYSTEM FROM 0 TO 30 PERCENT GERMANIUM. V. C. Petersen and R. W. Huber. June 1955. 23p.

The titanium-rich end of the Ti–Ge system was investigated by x-ray and metallographic methods and verified by resistivity and dilatometer measurements. A constitution diagram is proposed. The Ti-rich portion of the phase diagram is characterized by eutectic and peritectic reactions. The eutectic composition is 19% Ge, and the eutectic temperature 1,360°C. The peritectic reaction occurs at 905°C and 4% Ge. Germanium is soluble in alpha Ti to a maximum of 4% at 905°C and in beta Ti to a maximum of 12.5% at 1,360°C. Both limits of solubility decrease with decreasing temperatures. Although substantial quantities of Ge are soluble in beta Ti, beta is not retained on quenching. The beta phase probably transforms to alpha by a martensitic reaction. The temperature of the alpha to beta transformation is increased by the addition of Ge, resulting in a peritectic reaction at 905°C. Like Al and perhaps Sn, Ge is an alpha-stabilizing addition for Ti. Only one compound, Ti_5Ge_3, exists in the Ti-rich portion of the system up to 47% Ge. Some data are presented on the electrical resistivity and temperature coefficients of resistance and expansion for Ti and a few Ti–Ge alloys. (auth)

3679 BMI-1228
Battelle Memorial Inst., Columbus, Ohio.
VAPOR DEPOSITION OF MOLYBDENUM AND NIOBIUM COATINGS ON STAINLESS STEEL TUBES. Carroll F. Powell, Danny M. Rosenbaum, Robert B. Palmer, and Ivor E. Campbell. Oct. 2, 1957. 9p. Contract W-7405-eng-92. $0.50(OTS).

Apparatus was developed for vapor depositing molybdenum on the outside of 0.1835-in.-OD by 20-in.-long Type 304 stainless steel tubing by hydrogen reduction of molybdenum pentachloride or by thermal decomposition of molybdenum hexacarbonyl, both processes being carried out at reduced pressure. The coatings obtained were uniform, but quite brittle. Apparatus also was developed for vapor depositing niobium on the inside of the above-mentioned tubing by hydrogen reduction of niobium pentachloride at reduced pressure. These coatings were uniform, adherent, nonporous, and moderately ductile. (auth)

3680 ISC-83b
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY FOR JULY–DECEMBER, 1956. Aug. 23, 1957. 58p. Contract W-7405-eng-82. $1.50(OTS).

Purification and Separation Studies. Brief reports of progress in Nb–Ta and Hf–Zr separation are given, and investigations of a pyrometallurgical process for separating U and Th using Mg are described. Metal Preparation Studies. The following preparations were investigated: Nb, by C reduction of Nb_2O_5; Tn, by Na reduction of $ThCl_4$; U–Nb alloy by bomb reduction of UF_4 and Na_2NbOF_5, and U–Nb phase diagram Zn–Zr phase studies and vapor pressure of pure Mg are reported. Corrosion Studies. A study of steam corrosion of binary alloys of group VA and VIA metals is described. The effects of addition of Y on corrosion of some refractory metals were studied. Solid State Investigations. The following investigations are reported on: structure of Hf_5Sn_3; allotropic transformations in U; electronic specific heat of Ca metal; anisotropic thermal expansion of Zn; low-temperature properties of V; and structure of UZn_3. (For preceding period see ISC-759.) (T.R.H.)

3681 MAB-121-M
National Research Council. Materials Advisory Board.
UNIFORM TESTING PROCEDURES FOR SHEET MATERIALS. PART 4. BEARING TEST. PART 6. CRIPPLING TEST. Report No. 3 of Task Force on Uniform Procedures for Structural Design Data Collection. Nov. 27, 1957. 10p.

To provide some basis for uniformity in evaluating various Ti alloys, a uniform set of procedures was prepared for procuring data. These procedures will make it possible for the data from several laboratories to be compared on a uniform basis. Procedures for the two tests are given for specimen preparation, loading, instrumentation installation, and test data. (M.H.R.)

3682 NACA-TN-4062
Michigan. Univ., Ann Arbor.
ABNORMAL GRAIN GROWTH IN NICKEL-BASE HEAT-RESISTANT ALLOYS. R. F. Decker, A. I. Rush, A. G. Dano, and J. W. Freeman. Dec. 1957. 70p.

Controlled laboratory experiments were carried out on samples of bar stock of air- and vacuum-melted Waspalloy, Inconel X-550, and Nimonic 80A alloys to find conditions of heating and hot-working which resulted in abnormal grain growth. These experiments were mainly limited to normal conditions of heating for hot-working and for heat treatment. All the results indicate that small reductions of essentially strain-free material were the basic cause of abnormal grain growth. (auth)

3683 NP-6506
Battelle Memorial Inst., Columbus, Ohio.
METALLURGICAL AND MECHANICAL CHARACTERISTICS OF HIGH-PURITY TITANIUM-BASE ALLOYS. Quarterly Progress Report No. 5. F. C. Holden, J. A. Houck, H. R. Ogden, and R. I. Jaffee. May 31, 1957. 29p. Contract AF33(616)-3469.

Mechanical property data are presented for the alloy compositions and heat treatment conditions originally scheduled. These include tensile test data (including flow properties), hardness, impact behavior, and response to low temperature aging. Discussion has been mainly limited to the Ti–Mo base alloys, containing additions of Al, O, and C. (auth)

3684 NP-6509
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
THE PRESENT STATE OF DEVELOPMENT OF IRON–ALUMINUM-BASE ALLOYS. W. J. Lepkowski and J. W. Holladay. Nov. 18, 1957. 45p.

The purpose of this memorandum is to summarize the present state of development of iron–aluminum-base alloys. The binary iron–aluminum alloys offer favorable tensile strength but possess very poor ductility. The iron–aluminum–molybdenum alloy, thermenol (Fe–16Al–3 Mo), is corrosion resistant, offers excellent tensile strength, and is ductile. (A.C.)

3685 NP-6510
Brown Univ., Providence.
THE MEASUREMENT OF GRAIN CONTIGUITY IN TWO-PHASE ALLOYS. Technical Report No. 2. J. Gurland. Nov. 1957. 15p. Project No. 7B2-0001(1657). Contract DA-19-020-ORD-3976.

A method of measuring the degree of contact between grains of one phase in multi-phase alloys is derived. It is shown that the number and the areas of contacts between grains can be determined by metallographic analysis. Relations between the area of contact, the dihedral angle, and the mean free path are developed. (auth)

3686 NYO-1117(Rev.)
Brush Beryllium Co., Cleveland.
PROCESS DEVELOPMENT QUARTERLY PROGRESS REPORT FOR JULY, AUGUST, AND SEPTEMBER 1952. A. J. Stonehouse and W. W. Beaver. Oct. 15, 1952. Decl. Mar. 2, 1957. 29p. $4.80(ph OTS); $2.70(mf OTS).

Development work on the fabrication of Be and Th by powder metallurgical techniques is described herein. Studies leading towards the development of Be rod with an improved tensile elongation are presented. Current work on the process metallurgy of Be including ore extraction studies and the purification of crude Be solutions by solvent extraction is discussed. An investigation of the melting and casting of U in the presence of vibrational forces is described. (auth)

3687 WADC-TR-54-278(Pt. 4)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
DEVELOPMENT OF TITANIUM-BASE ALLOYS FOR ELEVATED TEMPERATURE APPLICATION. Period covered: January 1, 1956 to March 31, 1957. Frank A. Crossley, William F. Carew, and David W. Levinson. Mar. 1957. 65p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2853. (AD-142147).

A study was made of the effect of forging and heat treatment variables on the mechanical properties of Ti–Al–Mo alloy and the effect of sponge quality on the mechanical properties of Al–Mo alloy. The tensile, creep-rupture, and stability properties of Al–Ti–Nb, Al–Ge–Mo, and Al–Ge–Mo–Ti alloys were evaluated. (auth)

3688 WADC-TR-57-309
Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.
JOINING OF MOLYBDENUM. [Period covered] February 15, 1956 to April 14, 1957. W. N. Platte. 169p. Project title: CFPS MATERIALS. Task title: JOINING MOLYBDENUM. Contract AF33(616)-3524.

An examination of available metallurgical data on molybdenum base alloys indicated that additions of Al, Ti, C, and Zr should provide good welding properties. A group of the alloys selected was welded in a chamber containing an atmosphere of Ar. Mechanical and metallurgical tests showed that Al additions in the range of 0.18 to 0.22% gave welds that could be deflected 120° at room temperature. However, all the alloys containing Al showed fine porosity. Titanium additions of 0.5% produce welds which can be deflected 120° at temperatures between 80 and 120°F depending upon the amount of carbon in the alloy. Welds in 0.5% Ti with 0.05% C produced the best results. No porosity was observed in Ti alloys. Carbon in Mo–C alloys was shown to improve the weld metal ductility by reducing the oxygen content of the base material and by a protective deoxidization action during welding. Molybdenum with 0.06% C showed the best bend ductility within the carbon range examined. The effect of welding speed on the grain size of the weld metal was examined. While it is theoretically possible to reduce the weld metal grain size by increasing the welding speed, experimental difficulties were encountered due to retraction of the weld metal at speeds of 2 cm/sec. Chilling the weld failed to overcome these difficulties. Post-welding residual stresses were measured and it was found that these stresses could be eliminated by a vacuum heat treatment at 1832°F. The residual stresses found in the welds prior to heat treatment are sufficiently large to produce fracture without additional applied stress. The post-welding stress relief was accomplished before the weld had cooled to the transition range. Crater cracking was effectively prevented by this heat treatment. (auth)

3689 WAPD-FE-644
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
FEASIBILITY OF APPLICATION OF THE BUNDY PROCESS TO THE MANUFACTURE OF ZIRCALOY-2 TUBING. L. F. Cochrun. Feb. 21, 1955. Changed from OFFICIAL USE ONLY Dec. 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

Studies indicate the Bundy process as applied to Zircaloy-2 is not feasible. (D.E.B.)

3690 TID-5426
Little (Arthur D.) Inc., Cambridge, Mass.
REPORT ON PRODUCTION OF HAFNIUM-FREE ZIRCONIUM TO CLIMAX MOLYBDENUM COMPANY. Dec. 29, 1951. Decl. Dec. 6, 1957. 56p., 2 illus. $1.50 (OTS). (ALI-C-58468).

A study has been made of possible processes for the production of hafnium-free zirconium of a grade suitable to meet AEC specifications. The purpose of the study has been to select the most suitable processes and develop detailed estimations of investment for four different sized plants to produce zirconium and the cost per pound of metal produced from the plants. Brief consideration has been given corollary matters such as basic zirconium sources, patents and publications on the subject as a whole, and the potential commercial applications of the metal. (auth)

3691 TID-10169
Brush Beryllium Co., Cleveland.
QUARTERLY PROCESS DEVELOPMENT PROGRESS REPORT FOR JULY, AUGUST, AND SEPTEMBER 1953. A. James Stonehouse. Nov. 30, 1953. Decl. Mar. 16, 1957. 28p. Contract AT-(30-1)-541. $0.35(OTS).

Development work on the stoichiometric reduction of beryllium fluoride with magnesium, the rapid pressing of beryllium powder both at room and elevated temperatures, the extrusion of beryllium tubing and the application of vibrational forces to the melting and casting of uranium is described. A brief summary of the elevated temperature properties of beryllium fabricated by powder metallurgy is also presented. (auth)

3692 TID-10170
Brush Beryllium Co., Cleveland.
QUARTERLY PROCESS DEVELOPMENT PROGRESS REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1953. A. James Stonehouse. Feb. 15, 1954. Decl. Sept. 15, 1957. 26p. Contract AT(30-1)-541. $0.35(OTS).

Development work on the stoichiometric reduction of beryllium fluoride with magnesium, the production of beryllium nitride slugs, the rapid pressing of beryllium powder below and at sintering temperatures, and the extrusion of beryllium tubing is described. Initial work on the beryllium cladding of fuel elements and the preparation of high elevated temperature strength beryllium-rich alloys is discussed. Further work on the application of vibrational

energy to the melting and casting of uranium is presented. (auth)

3693 TML-88

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE SALT CORROSION OF TITANIUM ALLOYS AT ELEVATED TEMPERATURE AND STRESS. Progress Report. Nov. 20, 1957. 54p. Contract AF18(600)-1375.

The data for this report were obtained in the research departments of: Mallory-Sharon Titanium Corp.; Pratt and Whitney Aircraft Div.; Rem-Cru Titanium, Inc.; Republic Steel Corp.; and Titanium Metals Corp. of America.

High temperature stress corrosion of Ti and Ti alloys by NaCl has caused cracking in laboratory tests. The results of investigations of this type of corrosion as affected by composition, heat treatment, creep, and the presence of NaCl crystals are given. The commercial alloys studied were Ti–Al–V, Ti-155A and -140A, and Ti–Al–Sn. A possible mechanism is discussed. (T.R.H.)

3694 USBM-C-22

Bureau of Mines. Northwest Electrodevelopment Lab., Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD OF SEPTEMBER 15–DECEMBER 15, 1954. Jan. 20, 1955. Decl. Mar. 7, 1957. 41p. Contract AT(11-1)-140. $6.30 (ph OTS); $3.00(mf OTS).

Production of zirconium was continued at the rate of 20,000 lbs/mo and hafnium at the rate of about 750 lbs. Controlled plant runs using liners in the Zr reduction pots showed that many of the previous drawbacks can be removed by increasing the $Mg/ZrCl_4$ ratio, by using spiked bottoms in the chloride cans, and by improving operating techniques. The study of the mechanisms of metallic arcs covered a number of changes that occur in various arcs as the pressure is reduced. Equations involving the effect of a number of variables on the cathode consumption rate are presented. A high speed camera was used to photograph several operating arcs, and it was apparent that the action of the electric arc will be revealed with more clarity than was anticipated. Calcium vapor treatment for Zr scrap was used on one 1667 lb lot of Zircaloy 2. The oxygen content was reduced from 1550 to about 1100 ppm with a recovery of about 75% of the clean chips. Other tests involving Ca vapor deoxidation of Hf scrap, molten Ca deoxidation baths, and H_2SO_4 pickling of Zr scrap were continued. Continuing hot water corrosion tests of a considerable number of Zircaloy 2 type alloys are reported. Zircaloy 2 contaminated with 0.5% oxygen suffered a decided impairment in corrosion resistance. Sections of Zircaloy 2 Hanford process tubing have much lower weight gains than unalloyed tubing after tests in both 600 and 680°F water. An improved melting point technique was developed for the temperature range 1500 – 2500°C, and the melting point of hafnium is now placed at 2182 ± 30°C. A list of topical reports prepared under this contract for the period July 1, 1954 to December 31, 1954 is included. (auth)

3695 USBM-U-210

Bureau of Mines. Northwest Electrodevelopment Experiment Station, Albany, Oreg.

ZIRCONIUM PROGRESS REPORT FOR THE PERIOD JUNE 15–SEPTEMBER 15, 1956. Haruo Kato, Robert A. Beall, Henry P. Holmes, and Glen C. Ware. Oct. 10, 1956. Changed from OFFICIAL USE ONLY Aug. 30, 1957. 28p. Contract AT(11-1)-140. $4.80(ph OTS); $2.70(mf OTS).

The production of Zr by Na reduction of $ZrCl_4$, operating techniques for production of high-purity Zr by Mg reduction of the chloride, volatility of impurities in Zr under vacuum arc melting, and the casting of Zr for reactor and other purposes are reported. Damaging explosions in arc melting furnaces for Ti were studied. The corrosion resistance of Na reduced Zr and zircaloy, the effects of N on corrosion of Hf, and the effects of Al on corrosion of Zr were considered. (J.E.D.)

3696 WADC-TR-53-190(Pt. 5)

Firth Sterling Inc. American Electro Metal Div., Yonkers, N. Y.

NEW HIGH TEMPERATURE INTERMETALLIC MATERIALS. [Period covered] September 2, 1955 through November 2, 1956. R. D. Grinthal. Nov. 1956. 65p. Project title: CERAMIC AND CERMET MATERIALS. Task title: HIGH TEMPERATURE AND HIGH STRESS CHARACTERISTICS OF CERAMICS AND CERMETS. Contract AF33(616)-3198. (AD-110684).

Six ternary systems were investigated as to physical properties, oxidation resistance, mechanical properties, phase studies, and electrical resistivity. They were: Cu, Cr, and Ti with Mo–Si, Cr–Ti–Si, Ti–Al–Ni, and Cr–Ti–Cu. (T.R.H.)

3697 WADC-TR-56-633

New York. State Univ. Coll. of Ceramics, Alfred.

RESEARCH ON INTERMETALLIC CONTAINERS FOR MELTING TITANIUM. [Period covered] September 1, 1955 through October 31, 1956. William B. Crandall, Carl H. McMurtry, and Daniel D. Button. Oct. 1956. 38p. Project 7350. Contract AF33(616)-3172. (AD-118029).

The usefulness of Mo_3Al as a container for the melting of Ti has been determined under a number of experimental conditions. Although this container is wet by the Ti during melting, only a total of 3% of Mo and Al is taken into the melt if the time and temperature of melting is held to a minimum. (auth)

3698 WADC-TR-57-269

Denver. Univ. Denver Research Inst.

PARTITION OF SOLUBLE CARBON IN Ti–6Al–4V ALLOY. Period Covered: February 1, 1956 to February 28, 1957. Richard D. Seibel, Richard L. Beck, and Leonard E. Olds. July 15, 1957. 78p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF-33(616)-3349. (AD-142137).

The mechanism by which alpha-beta Ti alloys are embrittled by small amounts of interstitial-type solutes such as N, O, and C can not be fully understood until more is known of the microdistribution of these dissolved impurities in the two-phase alloys. This report describes the results of an investigation of possible means for determining the micro-distribution of these impurities, particularly in the more complex alloys. A useful method was developed for measuring microdistribution of solutes in alloys. This method was completely independent of the presence of other solute elements, whether interstitial or substitutional. In addition, some information is presented regarding the use of microautoradiographic techniques to study the microdistribution of the interstitial type solutes in two-phase Ti alloys. (auth)

3699 WADC-TR-57-360

[Illinois Inst. of Tech.], Chicago. Armour Research Foundation.

RESEARCH ON THE EFFECTS OF STRESS, STRAIN, AND TEMPERATURE ON THE EUTECTOID DECOMPOSITION OF TITANIUM ALLOYS [Period covered] February 1, 1956 to May 30, 1957. Adolph W. Goldenstein, Arthur G. Metcalfe, and William Rostoker. May 27, 1957. 72p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-3394. (AD-142142).

Three Ti–Cr alloys were forged in the α-β range to give six systems with controlled amounts of each phase.

The isothermal transformation at 400, 500, and 600°C of each of these systems was followed by resistivity, x-ray diffraction, elastic modulus measurements, and metallography. The reactions occurring in the transformation were identified where possible. This transformation study was repeated under a stress which produced 1% creep in 1000 hr. An acceleration of four to seven times in the rate of transformation occurred under the action of this stress. Complete tensile test data were obtained at all stages of the transformation and plotted on the T-T-T diagrams. These reveal that the formations of omega and $TiCr_2$ are the embrittling reactions. The eutectoid temperature in the Ti–Cr system was determined to be 670° ± 5°C. (auth)

3700 WAL-TR-401/265

Watertown Arsenal Lab., Mass.

QUANTITATIVE PHASE ANALYSIS IN TITANIUM BY X-RAY DIFFRACTION. Stanley L. Lopata. Dec. 1957. 24p. DA Project 5B93-08-021.

In view of present difficulties encountered in metallographic methods of phase analysis of Ti and its alloys, the possibility of utilizing integrated x-ray intensities for phase analysis was investigated. Power Formula variables were calculated for Ti, and relative areas of three alpha and one beta peak were determined. Recorded x-ray intensities were obtained from a large number of Ti specimens. The recorded intensities were analyzed and the results compared with those from metallographic analysis. The errors in the method arising from the nature of Ti, preferred orientation and peak overlapping, were studied and where possible, compensated for by adjusting the method of measurement and calculation. (auth)

3701 WAPD-179

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

CONTAMINATION OF ZIRCONIUM–URANIUM BY RECYCLING OF SCRAP. L. F. Cochrun and J. C. Szurley. Jan. 1957. 15p. Contract AT-11-1-GEN-14. $0.50(OTS).

The effect of continued recycling of fuel alloy scrap (6.33 wt. % U + Zircaloy-2) on chemical composition and physical properties is reported. Three series of five ingots each were melted, each ingot having 30% scrap from the previous ingot in its series. Impurity levels, tensile data, hardness and fabricability are reported. There were no apparent detrimental effects caused by continued recycling of this alloy. (auth)

3702 WAPD-NCE-2261

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

INVESTIGATION OF THE EFFECT OF FUEL FILLER SURFACE CONDITIONING UPON FUEL ELEMENT PROPERTIES. Stuart Weiss. Nov. 9, 1956. Decl. May 2, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

The results of two test runs conducted with surface-conditioned fuel fillers are reported to evaluate the effect upon diffusion zone thickness, bond strength, and corrosion properties of Zircaloy-2 clad U–10 wt. % Nb. Results indicate that there is no significant effect of fuel surface condition upon diffusion zone thickness. The bonding interface of the rolled fuel element has greater strength than either the clad or the rod. The corrosion data were inconclusive because of the small number of tests, the uncontrolled variables, and the erratic corrosion properties of the particular U–Nb alloy used. (L.T.W.)

3703 WAPD-RM-163

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A METHOD FOR TINNING SPONGE ZIRCONIUM. H. R. Hoge. Dec. 20, 1952. Changed from OFFICIAL USE ONLY Dec. 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

A special hot dipping process for adding Sn to Zr sponge for the preparation of homogeneous Sn–Zr alloys is described. The correct amount of Sn is obtained by blending tinned and untinned sponge and consumable electrode melting. A study of time, temperature, and pressure during hot dipping indicated Sn pickup by the sponge is governed by laws similar to those of capillary action. Good alloys were prepared with Sn contents from 0 to 20%. (D.E.B.)

3704 AEC-tr-3102

STUDY OF INTERMETALLIC DIFFUSION PHENOMENA IN THE URANIUM–ZIRCONIUM SYSTEM. Y. Adda, J. Philibert, and H. Faraggi. Translated by K. S. Bevis from Rev. met. 54, 597-610(1957). 20p.

The results of a study of the uranium–zirconium intermetallic diffusion at high temperature are presented. This study enabled the author to determine the characteristic diffusion constants of these two metals. (A.C.)

3705

MEASUREMENT OF THE SELF-DIFFUSION CONSTANTS IN α-PHASE IRON USING RADIOACTIVE TRACERS. Claude Leymonie, Paul Lacombe, and César Libanati. Compt. rend. 245, 1922-5(1957) Nov. 25. (In French)

3706

IMPROVED FABRICATION TECHNIQUES AND LOWER COST FAVOR TITANIUM'S USE. Corrosion 14, 119-20, 122(1958) Jan.

Fabrication characteristics of Ti are discussed in connection with the proposed use of the metal for chemical equipment. Principal physical properties of two grades of commercially pure Ti are listed and a comparison made with Type 304 stainless steel. Cost data are given to show the economic feasibility of using Ti for a reactor and heat exchanger as contrasted with that of two other metals. A number of recommendations are made regarding the procedure to be followed in welding Ti. (auth)

3707

SOME PROPERTIES OF POLYMORPHIC $\beta-\alpha$ CONVERSION IN PURE IODIDE TITANIUM. E. I. Antipova, M. B. Guterman, and M. G. Lozinskii. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 9, 45-9(1957) Sept. (In Russian)

Kinetic processes in $\beta-\alpha$ conversion of iodide Ti with small admixtures of Fe, Si, Al, and C were studied at room temperature and at temperatures up to 1000°. The rate of formation and growth of α titanium crystals exceeds $^1/_{10}$ sec and may continue up to 0.8 to 1.2° sec. Microstructures and diagrams showing the kinetic growth and changes in the microstructure of α titanium specimens are presented. (R.V.J.)

3708

ON THE RELATION BETWEEN THE DIFFUSION AND HEAT RESISTANCE IN NICKEL ALLOYS. I. I. Kornilov and A. Ya. Shinyaev. Izvest Akad. Nauk S.S.S.R. Otdel Tekh. Nauk, No. 9, 50-5(1957) Sept. (In Russian)

Measurements of diffusion coefficients for Ni–Ti, Ni–Ti–Cr, and Ni–Ti–Cr–W–Al alloys showed that the binary alloy had the highest diffusion coefficient at all temperatures. At temperatures up to 1100° the five component alloy had the lowest diffusion coefficient, at temperature above 1100° it becomes equal to the diffusion coefficient of the triple alloy, and at 1200 to 1250° it exceeds the diffusion of the triple alloy. The activation energy of diffusion for each alloy is 73.1, 84.0, and 91.3 kcal/g-atom for the binary, triple, and quintuple alloys, respectively. (R.V.J.)

3709

EFFECTS OF THE PHASE CONTENT ON THE HEAT RESISTANCE OF Cu–Cr–Zr ALLOYS. V. M. Glazov, M. V. Zakharov, and M. V. Stepanova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk No. 9, 123-6(1957) Sept. (In Russian)

Constitution diagrams of solid-state Cu–Cr–Zr alloys (3.5 % Cr and 3.5% Zr) were investigated at 900°. The strongest phase resistance of the alloy was found within in the phase region $\alpha + Cr_2Zr$ or the quasibinary cross section of $Cu-Cr_2Zr$. The maximum was observed in the heterogenic alloys with 0.8 to 1.2% Cr_2Zr. (R.V.J.)

3710

HEAT RESISTANCE AND THERMAL HARDNESS OF NICKEL–CHROMIUM ALLOYS. N. T. Domotenko and I. I. Kornilov. (Military-Aeronautics Engineering Academy). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 10, 36-40(1957) Oct. (In Russian)

The heat resistance of Ni–Cr alloys was tested at 800°C with stresses of 8, 10, 12.3, 14.3, and 15.8 kg/mm^2, and at 700, 800, 850, and 900°C with 10 kg/mm^2 stress. Analysis showed that at 800°C with 10 kg/mm^2 stress the alloys with 5 to 25% Cr have a considerably higher rate of creep than any of the other alloys. Hence, the investigations were made with alloys containing 30 to 50% Cr. (R.V.J.)

3711

ON THE ROLE OF A REDUCER IN SINTERING PROCESSES OF ALUMINUM AND TITANIUM ORES. E. I. Khazanov (Eastern-Siberian Branch of Acad. of Sciences U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Otdel Tekh. Nauk, No. 10, 55-60(1957) Oct. (In Russian)

Investigations were made of reducer effects in sintering processes, and a technological scheme is offered for high iron and silica Al and Ti ores. The feasibility of using the sintering method in the presence of a reducer for reprocessing Ti concentrates is discussed. A method is developed for determining the temperature interval in sintering. (R.V.J.)

3712

DENSITY AND RESISTIVITY CHANGES IN Au–Cd UPON QUENCHING. W. J. Sturm and M. S. Wechsler (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 28, 1509-10(1957) Dec.

3713

OCCURRENCE OF THE META-STABLE OMEGA PHASE IN ZIRCONIUM ALLOYS. B. A. Hatt, J. A. Roberts, and G. I. Williams (Fulmer Research Inst., Stoke Poges, Bucks). Nature 180, 1406(1957) Dec. 21.

3714

THERMAL CONDUCTIVITY OF NICKEL AND URANIUM. G. J. Pearson, P. O. Davey, and G. C. Danielson (Iowa State Coll., Ames). Proc. Iowa Acad. Sci. 64, 461-5(1957) Dec. 12.

An improved apparatus for measuring the thermal conductivity of metals at high temperatures by the gradient comparison method has been constructed. Our data for commercial A nickel and for pure uranium from 150°C to 650°C indicate that the comparison method is comparable (but not superior) to other methods of measuring thermal conductivity at high temperatures. (auth)

3715

MEASUREMENTS OF SPECIFIC HEAT BY A PULSE METHOD. R. C. Strittmater, G. J. Pearson, and G. C. Danielson (Iowa State Coll., Ames). Proc. Iowa Acad. Sci. 64, 466-70(1957) Dec. 12.

A pulse heating method for measuring the specific heats of metals at high temperatures has been developed. Preliminary results have been obtained for platinum and nickel in the temperature range 20°C to 450°C. With further development, the pulse heating method seems to show considerable promise of becoming a superior method for the measurement of specific heats at high temperatures and particularly useful in the study of phase transitions. (auth)

3716

INVESTIGATION OF THE ALLOTROPIC TRANSFORMATION $\alpha \rightleftharpoons \beta$ Zr WITH THE AID OF AN ELECTRONIC PROJECTOR. A. P. Komar and V. N. Shrednik (Academy of Sciences, USSR). Soviet Phys. JETP 5, 127-8(1957) Aug.

3717

TRANSFORMATION KINETICS OF ZIRCONIUM–URANIUM ALLOYS. D. L. Douglass, L. L. Marsh, Jr., and G. K. Manning (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Soc. Metals 50, Reprint No. 20, 1-25(1957).

The transformation kinetics of Zr alloys containing 8.85, 11.1, 14.3 and 20.7 wt. % U have been determined by metallography and x-ray diffraction. The effect of increasing U content in the alloys was to retard alpha Zr precipitation and to accelerate the precipitation of supersaturated epsilon, an intermediate phase. Direct quenching of the 8.85, 11.1, and 14.3 wt. % alloys resulted in the formation of alpha prime, a martensitic alpha-zirconium structure. Some epsilon prime (supersaturated epsilon) was observed in all the alloys; however, the 20.7 wt. % alloy was essentially 100% epsilon prime in the quenched condition. An unusual structure, tentatively called bainitic alpha, was observed in several of the 8.85 and 11.1 wt. % alloys which were isothermally transformed at 550°C or lower. The data are presented in the form of T-T-T curves. (auth)

3718

MAGNESIUM CASTING TECHNOLOGY. A. W. Brace and F. A. Allen. New York, Reinhold Publishing Corporation, 1957. 174p.

The following material is presented in this volume: magnesium casting alloys; magnesium alloy melting practice; moulding and core sands; production of sand casting; gravity and pressure die-casting; heat treatment of magnesium alloy casting; the inspection of magnesium alloy castings and notes on common defects; surface treatment; and applications of magnesium castings. (W.L.H.)

PHYSICS

3719 AERE-ES/M-6

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TESTS ON TWO SUGGESTED ACOUSTIC LININGS FOR BUILDING 443. H. Wells. Oct. 7, 1954. Decl. Aug. 29, 1957. 7p.

3720 CCC-1024-TR-263

Callery Chemical Co., Penna.

THERMODYNAMICS FUNCTIONS FOR SELECTED COMPOUNDS. C. R. Fuget and J. F. Masi—P. M. Maginnity, ed. Sept. 30, 1957. 23p. Project ZIP. Contract NOa(s)-52-1024-c.

The thermodynamic functions C_p°, $H^\circ - H_0^\circ$, S°, $(H-H_0^\circ)/T$, $-(F^\circ - H_0^\circ)/T$, $\log K_f$, ΔF_f°, and ΔH_f° have been calculated and tabulated at selected temperatures for the following compounds: boron nitride, 25 to 300°K; dimethoxyborane, 25 to 1500°K; dimethylaminodiborane, 25 to 275°K; methyl borate, 25 to 300°K; potassium borohydride, 25 to 300°K; sodium hydride, 25 to 400°K; sodium metaborate, 25 to 1200°K; sodium methoxide, 25 to 300°K; sodium tetraborate, 25 to 1000°K; sodium tetramethoxyborate, 25 to 300°K; triethylborane, 25 to 300°K; and trimethylborane, 25 to 200°K. (auth)

3721 MLM-1043
Mound Lab., Miamisburg, Ohio.
PHYSICAL PROPERTIES OF REACTOR FUELS. QUARTERLY PROGRESS THROUGH MARCH 17, 1955. J. F. Eichelberger. Mar. 31, 1955. Decl. Feb. 22, 1957. 13p. Contract AT-33-1-GEN-53. $1.80(ph OTS); $1.80(mf OTS).

3722 NAA-SR-2042
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SOLID STATE PHYSICS SEMIANNUAL PROGRESS REPORT [FOR] JANUARY–JUNE 1957. Dwain Bowen, ed. Nov. 15, 1957. 24p. Contract AT-11-1-GEN-8. $0.75 (OTS).

The results of a metallurgical study of the Th–rich end of the Th–U phase diagram are presented. A calculation of the electron band structure of α–Th was completed. The Hall coefficients of some Mo alloys of U were measured as a function of temperature from 4.2°K to room temperature. The superconducting properties of these alloys were also explored. Comparisons of radiation and cold work produced lattice defects at or near 4.2°K were started. Explanations of observed differences in the annealing of the two types of defects are discussed. (For preceding period see NAA-SR-1885.) (D.E.B.)

3723 NP-6480
MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 42 FOR AUGUST AND SEPTEMBER 1957. W. J. Posey, ed. Oct. 15, 1957. 26p. Contract NObs-65426.

Progress is reported on the following: A1W hydrodynamic test program; film boiling with water inside tube; simulation of a major pressurized water system rupture; simulation of vapor container venting under sea-water; chromate formation in high temperature water systems; fission product release during core meltdown simulation; and radioactivity associated with crud particle size ranges. (For preceding period see NP-6428.) (W.L.H.)

3724 ORNL-1301(Del.)
Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MAY 10, 1952. J. T. Howe, ed. Jan. 9, 1953. Decl. with deletions Feb. 20, 1957. 53p. Contract W-7405-eng-26. $9.30(ph OTS); $3.60 (mf OTS).

Progress is reported on the following studies: creep of stainless steel and inconel under irradiation, ORNL Graphite Reactor liquid-metals loop. LITR Na stress-corrosion loop, MTR fluoride-fuel loop, nuclear heating of materials, radiation damage to liquid fuels, thermal conductivity of structural materials, tests on irradiated graphite-UO_2 bars, position of bombardment-produced energy levels in Ge, radiation effects on KCl, half-life determination of Ge^{71} by electric measurements, resolution of precipitate nuclei sizes by retrogression phenomena, radiation-induced resistivity changes in Cu–Be alloy, physical properties of irradiated elastomers, and radiation damage to miscellaneous materials. (L.T.W.)

3725 Y-1181
Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
AIR DENSITY CORRECTIONS FOR REDUCTION OF WEIGHINGS TO VACUO. Eric E. Johnson. July 23, 1957. 16p. Contract W-7405-eng-26. $0.50(OTS).

A rapid method for the evaluation of the density of moist air for use in the reduction of weighings to vacuo is described and evaluated. Air density corrections employed in this method are derived. (auth)

3726 TT-692
X-RAY MEASUREMENTS ON SOLID NITROGEN AND OXYGEN. (Röntgenographische Untersuchungen an Festem Stickstoff und Sauerstoff). M. Ruhemann. Translated by H. A. G. Nathan from Z. Physik 76, 368-85 (1952). 28p.

Two apparatuses are described, one enabling single crystals of substances of low melting point to be prepared and investigated by the rotating-crystal method and the other permitting investigation of structure at temperatures between 16 and 80°K. Results were obtained from experiments on α- and β-nitrogen as well as on α- and β-oxygen. (tr-auth)

3727
DISTRIBUTION OF RANDOM POINTS IN A SURFACE. APPLICATION TO CLOUDING IN NUCLEAR EMULSIONS. Max Morand, Marie-Cécile Le Gentil and Simone Desprez-Rebaud. Compt. rend. 245, 1920-2(1957) Nov. 25. (In French)

The distribution of random points in a surface was studied. After determining the density of points per unit surface, ρ, the evaluation of the quantities l, the average of the smallest distance between these points, and K, defined by the expression $l = K/\sqrt{\rho}$ followed. Then, a comparison was made with observations of tracks among clouds in nuclear emulsions. (tr-auth)

3728
DIELECTRIC RELAXATION PROCESSES IN LITHIUM, SODIUM AND POTASSIUM HALIDES. J. S. Dryden and R. J. Meakins (C.S.I.R.O., Sydney, Australia). Discussions Faraday Soc. No. 23, 39-49(1957).

The dielectric properties of the Li, Na, and K halides containing divalent cation impurity have been studied at frequencies and temperatures where the relaxation absorption curves are clearly separate from the background loss due to d.c. conductivity. In several cases two distinct absorptions were observed, the higher frequency one being present only at higher concentrations of impurity. Activation energies have been obtained for the lower frequency absorption which is due to orientation of the dipole formed by association of a divalent cation and metal ion vacancy. These energies agree with those obtained from d.c. conductivity measurements for the movement of cations provided these are correctly interpreted, but are lower than the values generally accepted. A method is suggested for calculating these energy barriers using elastic constants which gives excellent agreement with experiment. A mechanism is suggested for the second absorption. (auth)

3729
THEORETICAL POSSIBILITIES FOR CONTROL OF THERMONUCLEAR FUSION. Peter Stoll. Industries Atomiques No. 9-10, 20-8(1957). (In French)

Early attempts at producing a controlled fusion reaction are reviewed, and the limitations and requirements for accomplishing this reaction are investigated theoretically. (T.R.H.)

3730
EMISSIVITIES OF METALLIC SURFACES AT 76°K. M. M. Fulk and M. M. Reynolds (National Bureau of Standards, Boulder, Colo.). J. Appl. Phys. 28, 1464-7(1957) Dec.

Heat transport by radiation between surfaces at 300°K and 76°K was measured to evaluate the effective emissivities of a number of technical grade or commercially available metals with unknown metallurgical history. The surface with the lowest total hemispherical emissivity was an unbuffed silver-plated surface. It was found that the emissivity of surfaces was lowest when used without any mechanical working and that the ability to absorb radiant energy varied with the length of time the surface was kept cold, even at a pressure less than 10^{-6} mm Hg, indicating surface contamination by residual gases. (auth)

3731
FIELDS IN GAP-EXCITED RECTANGULAR DUCTS. J. Van Bladel (Midwestern Universities Research Assoc. and Univ. of Wisconsin, Madison). J. Appl. Phys. 28, 1479-83(1957) Dec.

The electromagnetic field in a rectangular wave guide, cut in two by a plane perpendicular to its longitudinal axis, is investigated. A voltage applied across the two halves of the guide generates the field structure, which is analyzed for several values of the frequency (between zero and cut-off) and of the aspect ratio of the cross section. The problem is of interest for the design of particle accelerators. (auth)

3732
HEAT CAPACITY OF CALCIUM FROM 1.8 TO 4.2°K. Maurice Griffel, R. W. Vest, and J. F. Smith (Iowa State Coll., Ames). J. Chem. Phys. 27, 1267-9(1957) Dec.

The heat capacity of high-purity calcium has been measured over the temperature interval from 1.8 to 4.2°K. The electronic contribution is linear in T and the coefficient γ is 3.08 ± 0.01 millijoules/(gram-atom) deg^2 corresponding to a density of states at the Fermi level of 0.653 momentum state per electron volt per atom. A Debye temperature of 239 ± 2°K was obtained. For purposes of testing the calorimeter, the heat capacity of copper was determined. In agreement with other recent measurements, the value obtained for γ is 0.691 ± 0.006 millijoule/(gram-atom) deg^2 and θ_D is 3.42 ± 2°K. (auth)

3733
INVESTIGATIONS OF THE DETONATION PROPERTIES OF CONDENSED EXPLOSIVES WITH EQUATIONS OF STATE BASED ON INTERMOLECULAR POTENTIALS. I. RDX WITH FIXED PRODUCT COMPOSITION. W. Fickett and W. W. Wood (Los Alamos Scientific Lab., N. Mex.) and Z. W. Salsburg (Rice Inst., Houston, Texas). J. Chem. Phys. 27, 1324-9(1957) Dec.

An attempt is made to determine an average pair potential of intermolecular force for the mixture of product gases of the condensed explosive RDX (cyclotrimethylenetrinitramine) from measurements of the detonation velocity. The principal approximations are that the products of detonation consist of CO, H_2O, and N_2 in equimolar proportions and that the equation of state for this mixture can be calculated from theories of the free-volume type with the use of an average intermolecular potential. It was found that the average intermolecular potential was fairly well determined at distances somewhat less than the crossover distance. This result was almost independent of the choice of equation of state, although the calculated values of detonation temperature and pressure were not. (auth)

3734
SHOWERS IN LEAD PRODUCED BY 360 ± 30 Mev ELECTRONS. V. G. Ivanov, N. I. Petrov, V. A. Rusakov, Iu. A. Budagov, and V. T. Osipenkov (United Inst. for Nuclear Research). Soviet Phys. JETP 4, 934-5(1957) July.

Data on electron showers produced in Pb by 330 to 390 Mev electrons from the interaction of a beam of π mesons with the Pb are reported. (L.T.W.)

3735
CHARGE AND MOMENTUM ANALYSIS OF RELATIVISTIC PARTICLES BY THE NUCLEAR EMULSION TECHNIQUE IN PULSED MAGNETIC FIELDS. V. M. Likhachev and Iu. P. Merekov (USSR Academy of Sciences). Soviet Phys. JETP 5, 31-7(1957) Aug.

Strong pulsed magnetic fields (1.2×10^5 gauss) were used in experiments to observe particles from an electron accelerator in nuclear emulsions. The method was applied to measure the energy spectrum of bremsstrahlung from a synchrotron target, and to observe the annihilation of positrons in flight. (auth)

3736
STABILITY OF PLASMA IN A STRONG MAGNETIC FIELD. Iu. A. Tserkovnikov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 58-64(1957) Aug.

The stability of an inhomogeneous plasma with respect to small perturbations in a strong magnetic field is investigated. The plasma density and temperature and also the magnetic field strength are considered as given functions of space coordinates and as parameters on which the plasma stability is dependent. (auth)

3737
INVESTIGATION OF γ-RAYS FROM Po–Li AND Po–Mg NEUTRON SOURCES. Iu. A. Nemilov and A. N. Pisarevskii. Soviet Phys. JETP 5, 115-17(1957) Aug.

3738
CATHODE ELECTROLUMINESCENCE IN ZINC SULFIDE PHOSPHORS. H. Gobrecht, H.-E. Gumlich, H. Nelkowski, and D. Langer. Z. Physik 149, 504-10(1957). (In German)

3739
DETERMINATION OF THE RANGE-ENERGY RELATION FOR NITROGEN AND OXYGEN IONS IN PHOTOGRAPHIC EMULSIONS. D. M. Parfanovich, A. M. Semchinova, and G. N. Flerov (Academy of Sciences, USSR). Zhur. Eksptl.' i Teoret. Fiz. 33, 343-5(1957) Aug. (In Russian)

The dependence of range on energy has been measured for N and O ions in E-1 Ilford emulsions for energies between 3 to 120 Mev. The results are compared with theoretical predictions. It is also estimated at what energy the N and O ions lose all their electrons on tranversal of matter. (tr-auth)

3740
ON THE APPLICATION OF THE LEONTOVICH BOUNDARY CONDITIONS TO THE CHERENKOV RADIATION THEORY. A. I. Morozov (Moscow State Univ.). Zhur. Eksptl'. i Theoret. Fiz. 33, 933-5(1957) Oct. (In Russian)

The field of a charge moving above a flat boundary is computed using the Leontovich approximate boundary conditions. (tr-auth)

3741
PHYSICS AND TECHNOLOGY OF THE NUCLEAR REACTOR. Ferdinand Cap. Wien, Springer-Verlag, 1957. 515p. $15.25. (In German)

This textbook of reactor engineering is divided into nine parts: fundamentals of nuclear physics, neutron slowing down, neutron scattering, theory of homogeneous reactors, theory of heterogeneous reactors, reactor construction, reactor operation, descriptions of reactors, and applications of reactors. The text material is supplemented with graphs, charts, and pictures, and an extensive bibliography of periodical literature, books, and research reports is included. (Over 1,000 references on 170 topics). (T.R.H.)

Aerosols

3742 AFCRC-TN-57-297
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
A STUDY OF THE PARTICLE SIZE DISTRIBUTIONS OF AEROSOLS FROM LIGHT SCATTERING MEASUREMENTS. Scientific Report No. 1 (Report No. 6). T. L. Gilbert. Nov. 28, 1956. 52p. ARF Project No. A 060. Contract AF19(604)-1428. (AD-117190).

A critical inquiry into the general problem of calculating the particle size distribution of a polydisperse aerosol from light scattering measurements alone is presented. By restating the problem as an integral equation, $g(x) = \int h(x,y)f(y)\,dy$, (where $g(x)$ is directly obtainable from scattering measurements, $h(x,y)$ is given by the scattering properties of the individual aerosol particles and $f(y)$ is the unknown size distribution), it can be shown that the essential difficulties, heretofore ignored, are a consequence of experimental errors in $g(x)$, which may lead to non-existence of an exact solution and non-uniqueness of the solution if one exists. The difficulties imposed by these existence and uniqueness problems are shown to be characterizable by the "sensitivity" of the measured scattering properties to small changes in the size distribution. Numerical calculations of the scattering patterns and transmission spectra for various distributions of homogeneous aerosols with spherical particles are presented for the purpose of making qualitative estimates of the sensitivity. The backward ($0° \leq \gamma \leq 60°$) and forward ($150° \leq \gamma \leq 180°$) scattering patterns are found to be sensitive enough to justify optimism on the feasibility of determining size distributions from light scattering data alone. (auth)

3743

INTERMITTENT DETERMINATION OF RADIOACTIVE AEROSOL CONTENT IN AIR. R. Neuwirth. Atompraxis 3, 372-7(1957) Oct. (In German)

3744

CONTINUOUS MEASUREMENT OF RADIOACTIVE AEROSOL CONTENT IN THE AIR. W. Buchner. Atompraxis 3, 382-7(1957) Oct. (In German)

Astrophysics

3745

ANOMALY OF ELEMENTAL ABUNDANCE IN THE COSMOS. H. -H. Voigt. Naturwissenschaften 44, 501-4 (1957). In German)

3746

GIANT STARS WITH SHELL SOURCES OF C-N AND p-p REACTIONS. Chushiro Hayashi (Kyoto Univ.). Progr. Theoret. Phys. (Japan) 17, 737-42(1957) June.

Structures of giant stars of population II producing energy in the C-N shell source are studied taking account of the contribution of the ion pressure in the partially degenerate isothermal core and also of the exact fitting of the radiative region to the convective one. Further, it is found that pure hydrogen stars producing energy in the p-p shell source can also explain the giant branch of population II if the effect of the ion pressure is included in the core. (auth)

3747

ON NUCLEAR REACTIONS IN SUPER-DENSE COLD HYDROGEN. Ya. B. Zeldovich. Zhur. Eksptl'. i Teoret Fiz. 33, 991-3(1957) Oct. (In Russian)

It is shown that nuclear reactions occurring in cold hydrogen at densities of 10^4 to 10^6 g/cm^3 by quantum-mechanical penetration under the potential barrier proceed with a probability that is fully perceptible on an astrophysical scale. This circumstance puts a limit on the possible compression of cold hydrogen, since at a density of 0.7×10^5 g/cm^3 a celestial body cannot live longer than 10^8 years. Such a density is achieved in cold hydrogen under the action of gravitation in the case of a mass close to the mass of the Sun. (tr-auth)

Cosmic Radiation

3748

BIOLOGICAL EFFECTIVE DOSES OF COSMIC RAYS IN THE UPPER REGION OF THE ATMOSPHERE. Hermann J. Schaefer (U. S. Naval School of Aviation Medicine, Pensacola, Fla.). Atompraxis 3, 417-25(1957) Nov. (In German)

3749

A REMARK ON HIGH ENERGY PHENOMENA. Saburo Amai and Minoru Nishida (Kyoto Univ.) and Toshiyuki Murota (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 17, 807-12(1957) June.

A possible model which discriminates π-N, K-N, and N-N collisions in the cosmic-ray energy region is proposed. The difference in dependence of the multiplicities on the energy of incident particles in π-N, K-N, and N-N collisions is discussed, which is due to the difference of the kinds of the incident particles. Experimental data obtained with nuclear emulsions are analyzed by using the model. If the model is justified, the mean energy of the secondary particles of the π-primary jets must be greater (about twice) than that of the N-primary one, both in nucleon target and nucleus target cases. (auth)

3750

ACCELERATION OF COSMIC RAYS BY HYDROMAGNETIC WAVE. Y. Terashima (Kyoto Univ.) and K. Kitao and K. Ogawa (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 17, 814-15(1957) June.

3751

SPATIAL DISTRIBUTION OF THE PARTICLES OF EXTENSIVE AIR SHOWERS PRODUCED BY PRIMARY COSMIC RAYS OF VARIOUS ENERGIES. S. P. Dobrovol'skii, S. I. Nikol'skii, E. I. Tukish, and V. I. Iakovlev (Academy of Sciences, USSR). Soviet Phys. JETP 4, 799-801(1957) July.

The spatial distribution of charged particles in the central region of extensive air showers produced by primary cosmic ray particles of various energies was experimentally investigated. It has been found that, within the limits of experimental error, the spatial distribution is independent of the energy of the primary particle producing the shower in the energy region of 10^{13} to 6×10^{15} ev. (auth)

3752

ON THE MASS SPECTRUM OF CHARGED COSMIC RAY PARTICLES. A. I. Alikhanian, N. V. Shostakovich, A. T. Dadaian, V. N. Fedorov, and B. N. Deriagin (Academy of Sciences, USSR and Academy of Sciences, Armenian SSR). Soviet Phys. JETP 4, 817-30(1957) July.

Results of an investigation of the cosmic ray particles mass spectrum at 3200 m are reported. The measurements were carried out by means of a magnetic spectrometer used in conjunction with two cloud chambers. Protons, deuterons, π mesons, and K particles were observed among the particles locally generated in stars above the experimental arrangement. The cases of 11 particles with masses of about 500 to 600 m_e stopping in the lower chamber are discussed. In all these events, neither a star nor a shower was observed in the upper chamber. It was found that some of these particles entered the apparatus from the outside in a similar manner to the μ mesons. (auth)

3753

AN ANALYSIS OF SOME COSMIC RAY MESON PRODUCTION EVENTS. II. N. G. Birger, V. V. Guseva, K. A. Kotel'nikov, V. M. Maksimenko, S. V. Riabikov, S. A.

Slavatinskii, and G. M. Stashkov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 836-41(1957) July.

Three cases of meson production by cosmic rays are described. In each one, the momentum of the primary particle was measured by a magnetic method using two cloud chambers. The analysis confirms the existence of a large spread in the number of secondary particles and in the energy carried away by π mesons. (auth)

3754

INTERACTION OF 5-50 Bev COSMIC RAY PARTICLES WITH Be NUCLEI. I. N. G. Birger, N. L. Grigorov, V. V. Guseva, G. B. Zhdanov, S. A. Slavatinskii, and G. M. Stashkov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 872-82(1957) July.

Meson production by cosmic ray particles with energy 5 to 50 Bev was investigated in a cloud chamber containing a 9.8 gm/cm^2 Be plate under conditions closely approximating nucleon-nucleon interaction. Eleven interactions involving formation of four or more secondary charged particles are analyzed in detail. The angular distribution of pions and nucleons in the center-of-mass system of the two colliding nucleons was obtained, as well as the energy distribution of the energy of the primary particle among the various secondary particles. (auth)

3755

ON THE PROPAGATION OF CASCADES IN A MULTILAYER MEDIUM. Kh. Ya. Khristov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 877-82(1957) Oct. (In Russian)

A cascade of several types of particles propagating in a medium composed of homogeneous layers R^λ is considered. The boundaries of the layers may be mobile. The particles of the cascade collide with the particles of the medium, and in the process they are absorbed, scattered, and generate new particles. The functions W^λ are sought for that give the distribution of particles of each type according to positions and velocities in the assumption that the functions V^λ, which give the distribution of particles in each layer R^λ if it occupied the whole space, are known. For the unknown functions W^λ there are given an infinite series of integrals that in general show good convergence. The subintegral functions of these integrals are certain products of the functions V^λ. (tr-auth)

3756

ON CORRELATIONS IN THE DISTRIBUTION OF CASCADE PARTICLES. Kh.Ya. Khristov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 883-8(1957) Oct. (In Russian)

A cascade is considered made up of several types of particles that move in a given and in general nonhomogeneous medium varying in time. They collide with the particles of the medium and in this process are absorbed, scattered, and generate new cascade particles. The functions are considered known that characterize the distribution of particles of each type according to coordinates and velocities, if the cascade is composed of one particle of a given type, which particle appears at a given instant in a given point with a given velocity. By means of these functions the probability is found of the joint presence of the given numbers of cascade particles at given instants in given regions of positions and velocity. There is also given the probability of registration of these particles by means of devices which are able to register each entrant particle with a certain probability that depends on the type and velocity of the particles and on the instant and place of its entrance into the recording apparatus. (tr-auth)

Crystallography and Crystal Structure

3757

THERMOELECTRIC POWER OF IONIC CONDUCTING CRYSTALS. R. E. Howard (Clarendon Lab., Oxford) and A. B. Lidiard (Atomic Energy Research Establishment, Harwell, Berkshire). Phil. Mag. (8) 2, 1462-7(1957) Dec.

Crystals which conduct electricity by movement of the ions in the crystal have proved rather favorable subjects for the study of lattice defects, vacancies, and foreign ions. In particular, much is now known about their concentrations, their mobilities, and their interactions with one another. With the aim of extending the knowledge, particularly of the kinetic properties of the lattice defects, a study has been made of the electric power of ionic conducting crystals. Previous work on this topic has been almost entirely from the point of view of the theory of irreversible thermodynamics. The authors have approached the subject theoretically by making use of the models of Frenkel and Schottky lattice disorder and have obtained results which are consistent with the thermodynamic analysis but which allow more detailed predictions to be made. (A.C.)

Electrical Discharge

3758 LA-2077

Los Alamos Scientific Lab., N. Mex.

VACUUM SPARK PLASMAS. D. Finkelstein, G. A. Sawyer, and T. F. Stratton. Sept. 1956. 16p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

Observations of plasmas produced by sparks in vacuum are reported. The observations of greatest interest concern the speed with which such plasmas leave the spark. The principal conclusions about plasma speeds are that they are much higher than the thermal speeds associated with spark temperature, varying between 2×10^6 and 2×10^7 cm/sec, and they are surprisingly independent of the spark parameters in the range observed. (auth)

3759 AERE-Lib/Trans-758

NEW DEVELOPMENTS IN APPLIED ION AND NUCLEAR PHYSICS. Manfred von Ardenne. Translated by E. L. Poole from Atomkern-Energie 1, 121-6(1956). 16p.

Discussions of developments and illustrations of instruments are included on the following: the unoplasmotron ion-source, the duoplasmotron ion-source, ion sources for quadruply charged ions of medium atomic weight, precision mass spectrograph of high resolution with ion image-converter, a method of eliminating the polarization charges on the beam apertures, simple magnetic isotope separator for high mass transport, the importance and measurement of plasma stability in ion sources, and a scintillation image converter. (M.H.R.)

3760 AEC-tr-3101

SOLVING THE EQUATIONS OF MAGNETIC GAS DYNAMICS FOR ONE-DIMENSIONAL MOVEMENT. (Resheniye Uravnenii Magnitogazodinamiki dlia Odnomernovo Dvijenila). S. A. Kaplan and K. P. Staniukovich. Translated by M. I. Weinreich from Doklady Akad. Nauk S.S.S.R. 95, 769-71 (1954). 6p.

It is shown that the problems concerning an arbitrary 1-dimensional non-stationary gas flow with an infinitely great conductivity in a magnetic field can be reduced to the usual one-dimensional problems of gas dynamics, obtaining sufficiently general and universal solutions. (M.H.R.)

Electrons

3761

FOURTH ORDER MAGNETIC MOMENT OF THE ELECTRON. A. Petermann (CERN, Inst. for Theoretical Physics, Copenhagen). Helv. Phys. Acta 30, 407-8(1957).

3762

ELECTRON EMISSION IN MODERATE ACCELERATING FIELDS. D. W. Juenker (Univ. of Notre Dame, Ind.). J. Appl. Phys. 28, 1398-1450(1957) Dec.

Investigations of Schottky emission from metals, including some recent work, are summarized and discussed. The following are some of the conclusions: The surface barrier outside a uniform metal surface can be represented accurately by a mirror-image form for distances greater than about 20 A from the surface. Patch effects can be correlated to some extent with known surface properties. The dependence of photoelectric emission on applied field is in agreement with the Fowler theory adjusted for a Schottky-type field-dependent threshold. Periodic deviations from the thermionic Schottky effect are in full agreement with the mirror-image model for the extra-surface barrier, and can be used in determining the barrier form in the immediate vicinity of the emitter surface. (auth)

3763

TRANSMISSION OF ELECTRONS THROUGH METAL SURFACES. R. H. Good, Jr. (Iowa State Coll., Ames). J. Appl. Phys. 28, 1405-8(1957) Dec.

This paper is a review of recent developments in the theory of electron emission from metals. The main subjects discussed are the periodic deviations in the Schottky effect and the transition between thermionic and field emission. The indications are that each of these phenomena can be understood in terms of the free electron model for the metal and the transmission of the electrons through the image force barrier at the metal surface. (auth)

Instruments

3764 CML-M-124-3

Chicago. Univ. Chicago Midway Labs.

HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report [for] November 1957. H. Halle. 20p. Contract AT(11-1)-508. (CML-57-SR-M124-3). $3.30(ph OTS); $2.40(mf OTS).

Component and full-scale operational testing of sampling equipment for stratospheric air sampling is described. (D.E.B.)

3765 CREL-734

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

TRANSISTOR NOISE IN NUCLEONICS INSTRUMENTS. A. R. Jones. Nov. 1957. 22p. (AECL-524).

A brief description of the sources of noise in transistors are given. The performance of tubes and transistors is compared and the difficulties involved in using both in a circuit are discussed. Possible methods of improving the noise performance of transistors are mentioned. (M.H.R.)

3766 IDO-16388

Detroit Controls Corp., Redwood City, Calif.

DESIGN AND DEVELOPMENT OF A FUEL PLATE SURFACE THERMOCOUPLE FOR SPECIAL POWER EXCURSION REACTOR TESTS. Final Summary Report covering the period August 1956 through February 1957. W. H. Giedt and D. L. Rall. Feb. 15, 1957. 17p. For Phillips Petroleum Co., Contract AT(10-1)-205, Subcontract C-203. $0.75(OTS).

Two fuel plates were instrumented for testing in the SPERT-1 reactor, three chromel-alumel thermocouples being installed on each. The junctions on one plate were formed by transformer welding, using an overlay-plate technique, and those on the second by condenser-discharge welding. Bared ends of the sheathed leads were flattened to form the junctions. Performance has been reported to be satisfactory. (auth)

3767 IGR-R/CA-234

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

A HIGH-FREQUENCY INDUCTANCE LEVEL GAUGE FOR LIQUIDS IN INACCESSIBLE LOCATIONS. D. F. Davidson and J. Pilling. Oct. 1957. 16p.

A new type of level gage has been developed to give remote indications when measuring levels of corrosive and radioactive liquids in inaccessible locations. The principle of operation depends on the variation of inductance of a vertical metal rod which dips into the liquid. The indications are independent of liquid density, and the instrument is capable of a high order of accuracy in suitable conditions. An instrument operated in the laboratory gave an accuracy better than 1% using 1.0 N nitric acid as the liquid; the range of level variation was 40 cm. The probe in contact with the liquid is simple and inherently reliable. With a small number of simple electronic components close to the probe, a remote indication is obtained using a resonance method of inductance measurement. The principle is restricted to liquids of good conductivity, viz. a resistivity of 3 ohm/cm or less. A method of calculating the change in calibration from a perfectly-conducting liquid to one of finite conductivity is shown. The possibility of applying the principle to liquid metal level measurements is considered. (auth)

3768 IGR-R/CA-247

Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.

RECORDER FOR AN ARC FURNACE. W. Jaques. Oct. 1957. 6p.

A commercial 16-point recorder has been modified to give printed records from an arc furnace used for purifying rare metals, e.g., niobium. Interference in the measurements of arc current and voltage by the extremely large noise content is avoided by measuring the outputs from specially arranged vacuum thermo-junctions. This system also provides true r.m.s. readings of the signals. (auth)

3769 NACA-TN-3766

Lewis Flight Propulsion Lab., Cleveland.

RADIATION AND RECOVERY CORRECTIONS AND TIME CONSTANTS OF SEVERAL CHROMEL–ALUMEL THERMOCOUPLE PROBES IN HIGH-TEMPERATURE, HIGH-VELOCITY GAS STREAMS. George E. Glawe, Frederick S. Simmons, and Truman M. Stickney. Oct. 1956. 25p.

Radiation and recovery corrections and time constants were experimentally determined for several designs of shielded and unshielded thermocouple probes using chromel-alumel wire. Radiation and time constant data were obtained for Mach numbers from 0.3 to 0.9, static pressures from $\frac{2}{3}$ to $1\frac{1}{3}$ atmospheres, and temperatures from 1500° to 2500° R. Recovery data were obtained for Mach numbers from 0.2 to 0.9 and static pressures from $\frac{1}{7}$ to $1\frac{2}{3}$ atmospheres, at room total temperature. A review of the theory of gas temperature measurements and an analysis of the data show that simple empirical formulas can be used to correlate corrections for various gas-stream conditions. Tables and graphs are presented which show the correction factors of the various designs to aid in selecting a probe for a particular application. (auth)

3770 RAE-TN-GW-426

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

A NEW D.C. AMPLIFIER FOR GENERAL USE IN ELECTRONIC ANALOGUE COMPUTERS. P. R. Benyon. Aug. 1956. 44p.

An account is given of the design of a simple and compact direct-coupled amplifier, suitable for general use in electronic analogue computers. (auth)

3771 RAE-TN-MET-253

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

AN OPTICAL APPARATUS FOR CONTINUOUS MEASUREMENT OF SHRINKAGE AT HIGH TEMPERATURE. J. Hutchings and J. P. Roberts. Aug. 1956. 11p.

The apparatus works on the principle of the optical lever and is suitable for use in small furnaces up to at least 1300°C. It is made of sintered alumina, apart from the high-temperature mirrors of fused silica sputtered with platinum, or corundum crystal. The magnification of the change of thickness of the rectangular specimen is 70 times. The shrinkage of specimens approximately 1 cm thick can be determined to within 10μ, so that shrinkages greater than 5% are accurate to 1 part in 50 or better. The apparatus has been used to measure the shrinkage occurring during sintering of powder pressings. (auth)

3772 WCAP-546

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh and Pennsylvania Power and Light Co. Atomic Power Dept., Pittsburgh.

A SURVEY OF RHEOMETERS FOR USE WITH RAPIDLY SETTLING SLURRIES AT HIGH TEMPERATURES AND PRESSURES AND A PROPOSAL FOR DESIGN OF SUCH AN INSTRUMENT. R. J. Atkins, B. Hoffman, and G. R. Taylor. July 15, 1957. 36p. $6.30(ph OTS); $3.00(mf OTS).

As part of the over-all slurry characterization program for specifying the fuel to be employed in the Pennsylvania Advanced Reactor, the PAR Chemical Engineering Section is charged with the measurement of the rheological properties of aqueous ThO_2–UO_2 slurries. It is necessary to develop special methods for obtaining valid measurement of the rheological properties since this fuel will be a rapidly settling, non-newtonian, liquid-solid suspension, flowing under high temperatures and pressures. Various rheometers capable of use with rapidly settling slurries at high temperatures and pressures have been carefully surveyed to ascertain their merit. The theoretical basis for the design of a new instrument is presented. Design specifications for a specific instrument to be attached to PAR Corrosion Test Loop B are proposed. (auth)

3773

AUTOMATIC MEASUREMENT OF SCATTERING IN NUCLEAR EMULSIONS. Violette Brisson-Fouché. Compt. rend. 245, 1800-3(1957) Nov. 18. (In French)

An apparatus has been built which automatically carries out the calculations connected with experiments in scattering in nuclear emulsions. It can be used in the deflection method with elimination of parasitic scattering between the two counting chambers one of which is double the other. (T.R.H.)

3774

A CURRENT REGULATOR TO FACILITATE RESISTANCE MEASUREMENTS AT LOW TEMPERATURE. M. W. Thompson (Atomic Energy Research Establishment, Harwell, Berks). J. Sci. Instr. 34, 515(1957) Dec.

3775

FAST READ-OUT CHRONOTRON SYSTEM. Robert Meunier and Gilbert Davidson (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 28, 1010-15(1957) Dec.

A new electronic read-out system has been devised which enables one to obtain a fast answer from a chronotron to be used with accelerator beams of particles. It allows for an analysis of time delay with variable and continuous time intervals. The timing is pulse-height independent with an accuracy increasing for large pulses. The recovery time is in the range of one microsecond. With delay-line clipped coincidence pulses from two photomultipliers being fed into a 12-channel chronotron with a 30-mμsec range, a time resolution with half-width at half maximum of 1.2 mμsec was readily obtained. Using only 4 channels, with a range of 10 mμsec, a half-width at half maximum of 6×10^{-10} sec was observed. A simplified version with only three channels has made a useful fast coincidence circuit. (auth)

3776

FORTY-MEGACYCLE SCALER. Michiyuki Nakamura (Univ. of California, Berkeley). Rev. Sci. Instr. 28, 1015-20(1957) Dec.

A fast scaler is described that employs a fast flip-flop circuit of unique design. With techniques applied to fast trigger circuits, this flip-flop circuit has been triggered at a rate higher than 50 megacycles per second and has a double-pulse resolution of 20 millimicroseconds. A 40-megacycle scaler, with a scale of eight and employing this fast flip-flop as a basic element, has been built at this Laboratory. (auth)

3777

MILLIMICROSECOND DURATION LIGHT SOURCE. J. H. Malmberg (Univ. of Illinois, Urbana). Rev. Sci. Instr. 28, 1027-9(1957) Dec.

A simple circuit utilizing a hydrogen flash tube is described. The duration of the pulses of light is equal to or less than one millimicrosecond. (auth)

3778

IONIZATION GAUGES FOR MEASURING PRESSURES UP TO THE MILLIMETER RANGE. G. J. Schulz and A. V. Phelps (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 28, 1051-4(1957) Dec.

By designing an ionization gage such that the electron paths are short and well-defined and that the collection efficiency of the ion collector is near unity, one can extend the range of ionization gages to pressures of the order of a millimeter of mercury. Several specific tube constructions are proposed and the characteristics of the gages are discussed. (auth)

3779

GENERAL PURPOSE IMMERSION CRYOSTAT. N. Fuschillo and D. W. Krautkopf (Pennsylvania State Univ., University Park). Rev. Sci. Instr. 28, 1060-1(1957) Dec.

A cryostat is described for temperature control from 300° to −150°C. Novel features of this apparatus include a combined heating-cooling thermal exchange coil, good temperature homogeneity over the experimental volume combined with simplicity in design and ease of demountability and maintenance. By using other bath liquids the range of the cryostat can be extended to higher and lower temperatures. (auth)

3780

HIGH RADIATION-FLUX, ABSOLUTE, WATER-FLOW CALORIMETER. Peter E. Glaser (Arthur D. Little, Inc., Cambridge, Mass.). Rev. Sci. Instr. 28, 1084-6(1957) Dec.

A high radiation-flux, measuring calorimeter has been designed for use in imaging furnaces. It consists of a black-body receiver provided with a cooled aperture and cylindrical housing. It can be exposed to flux densities of the order of 400 cal/cm^2 sec for extended periods without

deterioration. Thermopiles measure the temperatures of the inlet and outlet cooling water. The calorimeter is an absolute measuring device with a response time of one minute. The design virtually eliminates heat losses and permits the measurement of a wide range of heat fluxes. The probable error in the radiation-flux measurement is ± 5%. (auth)

3781
LOW-TEMPERATURE CAMERA FOR X-RAY DIFFRACTOMETER. L. K. Jetter, C. J. McHargue, R. O. Williams, and H. L. Yakel, Jr. (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 28, 1087-8(1957) Dec.

A camera has been built for a horizontal x-ray spectrometer which enables observation to be made at temperatures as low as 1.2°K and which allows specimens to be worked at 5°K. The specimen is cooled by conduction from a Dewar of liquid nitrogen, and a heater makes possible operation up to 173°K. The camera was built for the vertical Norelco Diffractometer to study polycrystalline and powder samples in the temperature range 77° to 475°K with control to ± 0.5°K. (A.C.)

Isotopes

3782
STUDY OF THE β^+ RADIATION EMITTED BY LONG-LIVED ISOMERS OF Tc^{95}. Christiane Levi, Lily Papineau, and Noëlle Saunier. Compt. rend. 245, 1918-20(1957) Nov. 25. (In French)

The β^+ spectrum of Tc^{95} (60 day) has been studied; it is a complex spectrum with components having maximal energies of 680 ± 30 kev and 460 ± 30 kev and similar intensities. The total β^+ branching is of the order of 10^{-3} per disintegration. Their log ft (transition factor) values of 9.7 and 9 indicate the transitions are of the type $\Delta I = 2$, permissible. (tr-auth)

3783
ON SOLUTIONS OF He^3 AND He^4. S. K. Trikha and V. S. Nanda (Delhi Univ., India). Progr. Theoret. Phys. (Japan) 17, 679-710(1957) May.

A theory of He^3 and He^4 solutions has been developed on the basis of the following assumptions: He^3 mixes with the whole of He^4 (normal as well as superfluid); the contribution to the entropy of mixing is due only to the normal part of He^4; and the solution of He^3 in He^4 is not an "Ideal Solution" even above the λ-temperature. It obeys laws of a "Strictly Regular Solution." Agreement between theory and experiment concerning the λ-temperature of the solution, molar specific heat of mixing, vapor pressure in solution, the distribution coefficient, and the measurements of vapor pressures at dew points is found to be satisfactory. (auth)

Isotope Separation

3784 A-2120
Columbia Univ., New York. Div. of War Research.
THE SEPARATION OF THE BORON ISOTOPES. Isidor Kirshenbaum, Nestor Sabi, and Philip W. Schutz. Sept. 30, 1944. Decl. Feb. 13, 1957. 191p. Contract W-7405-Eng-50. (100B-R-221). $30.30(ph OTS); $8.70(mf OTS).

This method of separating the boron isotopes consists essentially in distilling a dissociable complex in a countercurrent system. A one-step fractionation factor of 1.016 ± 0.002 is obtained using the methyl ether and ethyl ether BF_3 complexes. The physical and chemical properties and thermal stability of these complexes and other related compounds are discussed in detail. Corrosion data are also included. A method for recovering the boron trifluoride from the ether complexes is given. This method involves the liberation of the ether by formation of the CaF_2-BF_3 complex and the subsequent decomposition of this salt complex at an elevated temperature. The various new tests, techniques, and pieces of apparatus devised are described. Other methods of separating the boron isotopes are given and evaluated quantitatively. (auth)

3785 DP-217
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
TRITIUM SEPARATION FACTOR IN THE CALCIUM–WATER REACTION. Daniel A. Brown. May 1957. 8p. Contract AT(07-2)-1. $0.50(OTS).

The separation factor for hydrogen and tritium was found to be 1.8 in the reaction of tritiated water and calcium metal at 85 to 95°C. An ionization chamber was calibrated with standards of tritiated water, and the calibration data were combined with this separation factor to yield a calibration curve for tritiated hydrogen gas samples. (auth)

3786 NP-6511 (Rpt: UNCLASSIFIED)
THE MAGNETO-IONIC EXPANDER ISOTOPE SEPARATOR ITS RELATION TO THE BOLTZMANN EQUATION IN THE ABSENCE OF PARTICLE COLLISIONS. Joseph Slepian. Nov. 1957. 14p.

Mass Spectrography

3787
MASS SPECTROMETER FOR THE STUDY OF ION-MOLECULE COLLISION PROCESSES. G. F. Wells and C. E. Melton (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 28, 1065-9(1957) Dec.

A controlled pressure mass spectrometer for the study of ion-molecule collision processes is described. A pressure ratio of 200 to 1 can be maintained between the ion chamber and the analyzer tube by means of differential pumping. Ion beams of the sample gas undergo collision reactions with molecules of the same or other gases in the analyzer tube. (auth)

Mathematics

3788 AECU-3497
Sandia Corp., Albuquerque, N. Mex.
EXTENSION OF EXISTING TABLES OF ATTRIBUTES SAMPLING PLANS. J. M. Wiesen. July 5, 1956. 239p. Contract AT(29-1)-789. (TM-146-56-51). $1.25(OTS).

3789 ASAE-20
American-Standard. Atomic Energy Div., Redwood City, Calif.
SOME REACTOR PHYSICS COMPUTING METHODS IN USE AT AMERICAN-STANDARD. Edward J. Leshan. June 1957. 17p.

A brief discussion of the theory and applications of the computing methods used are given. A list and very brief descriptions of the codes are included. (M.H.R.)

3790 LA-2157
Los Alamos Scientific Lab., N. Mex.
FINITE DIFFERENCE APPROXIMATIONS TO SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS. Burton Wendroff. Oct. 1957. 32p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

In this report is is shown that finite difference approximations to certain initial value problems for hyperbolic partial differential equations may be obtained by replacing

all partial derivatives by centered difference quotients. For systems in n independent variables, the stability and convergence of the approximate solution are demonstrated in a weak sense, and if n = 2, the approximate solution is shown to converge pointwise to the true solution. These results are obtained by the energy method of K. O. Friedrichs. The energy method is also used to show that the solution of a certain system of differential-difference equations obtained from the transport equation converges to the solution of the transport equation. (auth)

3791 NP-6513
California. Univ., Los Angeles.
BIBLIOGRAPHY ON RIEMANN SURFACES. Technical Report No. 6. Leo Sario. Dec. 1957. 43p. OOR Project No. 1517. Contract DA-04-495-ORD-722.

3792 WAPD-M-35
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
STATISTICAL TESTS OF SIGNIFICANCE INVOLVING THE MEANS AND STANDARD DEVIATIONS OF SMALL SAMPLES WITH APPLICATIONS IN THE MATERIALS DEPARTMENT. Lloyd B. Kramer. June 17, 1953. Changed from OFFICIAL USE ONLY Sept. 19, 1957. 56p. $9.30(ph OTS); $3.60(mf OTS).

Certain "test of significance" for measures of central tendency (means) and variation (standard deviation) in small samples are discussed. (L.T.W.)

3793
ON THE EXISTENCE OF A MIXING MEASURE. John C. Holladay (Los Alamos Scientific Lab., N. Mex.). Proc. Am. Math. Soc. 8, 887-93(1957) Oct.

It has been suggested that for sufficiently smooth transformations of a certain type, there might exist measures continuously related to Lebesque measure under which such transformations are mixing. An attempt is made to show the validity of this speculation. (M.H.R.)

Measuring Instruments and Techniques

3794 CF-55-8-104
Oak Ridge National Lab., Tenn.
IONIZATION CHAMBER MEASUREMENT OF BACK-SCATTER AND ABSORPTION OF BETA PARTICLES. T. E. Bortner and H. K. Richards. Sept. 1, 1955. 27p. $4.80(ph OTS); $2.70(mf OTS).

The ionization produced in a small air cavity by beta particles penetrating and backscattering from various thicknesses of matter is discussed. The effect of collimation of the particles and of changing the geometrical arrangement of the apparatus was also investigated. Discussions are included on the general features of electron transport phenomena, apparatus and procedure, absorption curves, saturation backscatter, variation of backscattering with thickness of backscatterer, absorption curves of backscattered radiation, and geometrical effects. (M.H.R.)

3795 DP-234
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
TRANSISTOR NEUTRON COUNT RATE METER. L. Earl Weisner, Jr. Aug. 1957. 11p. Contract AT(07-2)-1. $0.50(OTS).

An all-transistor neutron count rate instrument has been developed for use with a BF_3 counter. This instrument is inexpensive, highly reliable, and requires less maintenance than its vacuum-tube counterpart. (auth)

3796 DP-242
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A SIMPLE MONITOR FOR TRITIUM CONTAMINATION ON SURFACES. Donald W. Colvin. Oct. 1957. 12p. Contract AT(07-2)-1. $0.50(OTS).

Surface contamination by tritium was measured with an open-end ionization chamber that was operated as a dosimeter. The chamber could detect 12,000 d/m of tritium with a signal-to-noise ratio of ten. (auth)

3797 RDB(W)/TN-58(3rd Ed.)
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
AN ANTHOLOGY OF HEALTH PHYSICS DATA. H. J. Dunster. Oct. 1957. 55p.

A compilation was made of miscellaneous data found useful in solving problems of radiation protection. Notes and comments on the data are included. Topics covered include the estimation of radiation dose rates, the absorption of radiation, shielding, the decay of fission products, the counting of β and γ radiation, statistical methods, and miscellaneous data. (C.H.)

3798 USNRDL-TR-155
Naval Radiological Defense Lab., San Francisco.
RESPONSE CURVES FOR USNRDL 4-pi IONIZATION CHAMBER. Carl F. Miller. May 17, 1957. 77p. Project NS-083-001.

Response curves in terms of ma/Mev/s and ma/p/s as a function of incident photon energy have been determined for the USNRDL 4π ionization chamber. A computed curve for absorption of photons in the thimble wall and gas was used as an aid in determining the response curves from available calibration data for 39 radionuclides. This technique permitted a determination of the contribution of scattering from the chamber walls to the response of the instrument. This effect was negligible up to a photon energy of 0.47 Mev, after which it increased rapidly with photon energies up to about 1 Mev, and then increased more slowly to a maximum that was estimated to lie at a photon energy between 4 and 5 Mev. A procedure for using the response curves in conjunction with known decay schemes is illustrated. Proposed decay schemes and photon energy summations for several radionuclides are presented. The computational method should be applicable to other ion chambers and can be used to re-evaluate these response curves when a sufficient amount of additional data are available to warrant such a re-evaluation. (auth)

3799 WADC-TR-57-375
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
A METHOD FOR DETERMINING NEUTRON FLUX SPECTRA FROM ACTIVATION MEASUREMENTS. [Period covered] December 1956 to June 1957. Sven R. Hartmann. June 14, 1957. 30p. Project title: NUCLEAR INSTRUMENTATION SUB-SYSTEMS. Task title: NUCLEAR INSTRUMENTATION. (AD-142029).

A method for the determination of neutron spectra which approximates the neutron flux by a linear combination of the response functions (cross sections) of the detectors used in the spectral measurement is discussed. This linear combination is shown to approximate the neutron flux in the mean and to provide a calculated activation, for each detector, identical with that found in the experiment. Some practical cases are considered. A set of seven cross sections are used to approximate a fission, constant, and monoenergetic spectrum. A discussion of uncertainty propagation is given with illustrative examples for the fission and constant spectras. The integral neutron flux is also calculated and shown to be more adequately representable than the neutron flux. (auth)

3800
THE USE OF INTERSTITIAL RADIUM DOSE RATE TABLES FOR OTHER RADIOACTIVE ISOTOPES. John

Hale (Hospital of the Univ. of Pennsylvania, Philadelphia). Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 49-53(1958) Jan.

3801

INFLUENCE OF pH ON THE SENSIBILITY OF NUCLEAR PHOTOGRAPHIC EMULSIONS. J. Catalá and J. Casanova. Anales real soc. espan. fis. y quim. (Madrid) Ser. A 53, 169-78(1957) Sept.-Oct. (In Spanish)

This study of Ilford C2 emulsions shows that a smaller pH than the characteristic emulsion pH produced desensitization of the plate. A greater pH produces an increase in sensitivity. (T.R.H.)

3802

DOSIMETRY WITH AN IONIZATION CHAMBER. H. H. Naumann. Atompraxis 3, 362-8(1957) Oct. (In German)

3803

SOURCES OF ERROR IN THE INTERPRETATION OF MEASUREMENTS OF SPECIFIC PRIMARY IONIZATION USING A WILSON CLOUD CHAMBER. Remy Van de Walle and Julien Verhaeghe. Compt. rend. 245, 1721-3(1957) Nov. 13. (In French)

3804

LIQUID SCINTILLATORS. V. ABSORPTION AND FLUORESCENCE SPECTRA OF 2,5-DIARYLOXAZOLES AND RELATED COMPOUNDS. Donald G. Ott, F. Newton Hayes, Elizabeth Hansbury, and Vernon N. Kerr (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 5448-54 (1957)

Ultraviolet absorption data and wave lengths of maximum emission and mean wave lengths of fluorescence are presented. The synthesis and evaluation as scintillator solutes of previously unreported compounds are given. (auth)

3805

THE NEUTRON-DIFFRACTOMETER OF THE JOINT ESTABLISHMENT FOR NUCLEAR ENERGY RESEARCH AT KJELLER, NORWAY. J. A. Goedkoop (Joint Establishment for Nuclear Research, Kjeller, Norway). Ned. Tijdschr. Natuurk. 23, 140-1(1957).

3806

ABSOLUTE DETERMINATION OF MONOENERGETIC NEUTRON FLUX IN THE ENERGY RANGE 1 TO 30 Mev. S. J. Bame, Jr., Eugene Haddad, J. E. Perry, Jr., and R. K. Smith (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 997-1006(1957) Dec.

Monoenergetic neutron fluxes can be measured at neutron energies above 1 Mev by observing recoil protons scattered at forward angles from a hydrogenous radiator. A counter telescope system for observing the recoil protons is described which has a relatively high efficiency for neutron detection. The major part of the paper is devoted to backgrounds and corrections, the calculation of telescope efficiency, and the accuracy of neutron flux measurements. Tables are given which make possible a simple determination of the efficiency of a counter system at neutron energies between 1 and 30 Mev. An appendix presents a semiempirical formulation of n-p scattering which is used in obtaining counter efficiencies. (auth)

3807

DOSIMETER FOR HIGH-ENERGY NEUTRONS. P. S. Baranov, V. I. Goldanskii, and V. S. Roganov (Academy of Sciences, Moscow). Rev. Sci. Instr. 28, 1029-32(1957) Dec.

A neutron detector with a threshold at 20.6 Mev is described which is based on the $C^{12}(n,2n)C^{11}$ reaction in liquid organic scintillators. The efficiency of the detector is almost independent of neutron energy from ~40 Mev to ~400 Mev. The detector can be used to measure with an error of 6% high-energy neutron fluxes in the tolerance range (20 to 50 n/cm^2 sec). (auth)

3808

FILAMENT SCINTILLATION COUNTER. George T. Reynolds and P. E. Condon (Princeton Univ., N. Y.). Rev. Sci. Instr. 28, 1098-9(1957) Dec.

As a part of a program to develop a solid scintillation chamber, filaments of plastic scintillator material were prepared and formed into a scintillation counter. The filaments can be prepared in lengths of many feet. Care must be taken to avoid surface crazing. The diameter was chosen between 0.5 and 1.0 mm in view of the proposed application. The action of this sort of light pipes is well known, and a large number of diameters is possible. (A.C.)

3809

DEPENDENCE OF THE TAPER LENGTH OF EMULSION TRACKS ON PARTICLE CHARGE. D. V. Viktorov and M. Z. Maksimov. Soviet Phys. JETP 5, 42-4(1957) Aug.

Proceeding from Freier's hypothesis that the tapering of tracks is due to the increase of specific energy losses, it is suggested that an increase of the quantum yield of developed grains with increasing energy absorbed by the photographic layer takes place in nuclear as well as in x ray emulsions. The energies at which this phenomenon begins are approximately the same. The dependence of the taper length on the particle charge has been computed. The calculations satisfactorily agree with the available experimental data. (auth)

3810

DISTRIBUTION MEASUREMENT OF RADIOISOTOPES. PART II. Werner Schumacher and Dietrich Frost. Strahlentherapie 104, 110-17(1957). (In German)

3811

ON THE PROPAGATION OF THE DISCHARGE IN A SELF-QUENCHING COUNTING TUBE. E. Huster and E. Ziegler. Z. Physik 149, 583-93(1957). (In German)

Mesons

3812 NEVIS-44

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.

INTERACTIONS OF POSITIVE PIONS IN DEUTERIUM (thesis). Herman Winick. Mar. 1957. 69p. Contracts N6-ori-110, Task No. 1 and AT(30-1)-1932. (CU-139-57-ONR-110-1-Phys.). $10.80(ph OTS); $3.90(mf OTS).

Measurements have been made of the reactions (1) $\pi^+ + d \rightarrow \pi^+ + d$, (2) $\pi^+ + d \rightarrow \pi^+ + n + p$, and (3) $\pi^+ + d \rightarrow p + p$ at pion lab energies of 38 and 61 Mev using a liquid deuterium target and scintillation counters. A separation of the three processes is obtained by determining the mass and energy of reaction products using a pulse height analysis technique on the signals from the scintillation counters. Results from process (3) are compared with other processes involving two nucleons and a meson and results from processes (1) and (2) are compared with impulse approximation calculations. (auth)

3813 UCRL-3930

California. Univ., Berkeley. Radiation Lab.

THE NEUTRAL K MESON AS A PARTICLE MIXTURE (thesis). Richard Leon Lander. Sept. 25, 1957. 51p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60(mf OTS).

This experiment was designed to demonstrate the recent recently predicted particle-mixture property of the neutral K meson. The prediction asserts that the neutral K meson contains a short-lived component, θ_1^0, and a longer-lived component, θ_2^0. The θ_2^0 should have the property that it regenerates the short-lived component and also produces hyperons upon traversing matter. Under proper conditions the observation of such mesons or hyperons demonstrates

the predicted mixture property. The neutral K mesons in this experiment were produced by 1.25 Bev/c π^- mesons striking a 4- × 4- × 12-in. Al target. Neutral particles emitted from the Al at an angle of 5° with respect to the π^- beam traveled 9.3 ft to a propane bubble chamber operated in a 12-k gauss magnetic field. A sweeping magnet removed charged particles from this beam. θ_2^0 mesons could interact in the walls of the chamber or in the liquid propane, yielding θ_1^0 meson and Λ^0 hyperon decays in the sensitive region of the chamber. Twenty thousand pictures, corresponding to about 3×10^8 pions incident on the Al, were scanned for V^0 events. About 14 Λ^0 decays and about 12 θ_1^0 decays were observed. Spurious sources of these decays have been estimated to be negligible. (auth)

3814 UCRL-8007

California. Univ., Berkeley. Radiation Lab.
MASSES AND DECAY PROCESSES OF CHARGED HYPERONS (thesis). Peter C. Giles. Oct. 7, 1957. 48p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

The decay in nuclear emulsion of charged hyperons yields information about the hyperon masses and their lifetimes, as well as the K^--meson mass. The masses obtained in this study are $M_{\Sigma^+} = 2327.4 \pm 0.6\ m_e$, $M_{\Sigma^-} = 2340.3 \pm 1.4\ m_e$, and $M_{K^-} = 965.1 \pm 1.2\ m_e$. The best lifetimes are $\tau_{\Sigma^+} = 0.87^{+0.13}_{-0.10} \times 10^{-10}$ sec and $\tau_{\Sigma^-} = 1.7^{+1.2}_{-0.5} \times 10^{-10}$ sec. Furthermore, no evidence is found for a forward-backward asymmetry or anisotropy in the decay process. (auth)

3815

PROGRESS IN THE FIELD OF NEW ELEMENTARY PARTICLES. Erich Lohrmann. Atompraxis 3, 413-17 Nov. (In German)

3816

MASS DIFFERENCES OF Σ^+, Σ^- AND Σ^0 HYPERONS. Hiroshi Katsumori (Iowa State Coll., Ames). Progr. Theoret. Phys. (Japan) 17, 803-6(1957) June.

It is shown that there is a possibility to interpret the observed mass differences of Σ^+, Σ^-, and Σ^0 hyperons in terms of electromagnetic self-energies, if the Σ hyperons are assumed to be Dirac particles with anomalous magnetic moments of a few nuclear magnetons. (auth)

3817

THE PRODUCTION RATIO OF K^+ TO K^- MESONS. Yujiro Kakudo and Keizo Kobayakawa (Osaka Univ.). Progr. Theoret. Phys. (Japan) 17, 823-5(1957) June.

3818

PRODUCTION OF POSITIVE MESON PAIRS BY ONE MESON. R. Omnes (CERN, Geneva). Nuovo cimento (10) 6, 780-95(1957) Oct. (In French)

A system of generalized Low equations in the model of Chew is established. The cross-section for production of two positive π mesons in a P-state is deduced by a one-meson approximation. The corresponding integral equation is numerically solved by using the experimental phase-shifts and the invalidity of an iteration solution is showed. Every numerical approximation done in the text was tested. (auth)

3819

INTERACTION OF 230-250 Mev NEGATIVE π-MESONS WITH CARBON AND LEAD NUCLEI. V. P. Dzhelepov, V. G. Ivanov, M. S. Kozodaev, V. T. Osipenkov, N. I. Petrov, and V. A. Rusakov (Academy of Science, USSR). Soviet Phys. JETP 4, 864-72(1957) July.

The interaction of 230 to 250 Mev negative pions with carbon and lead nuclei was investigated by the method of the Wilson chamber in a magnetic field. The total and differential cross sections for both elastic and inelastic scattering were determined, as well as the total cross section for all the inelastic scattering processes. Within the experimental errors, the elastic scattering is in agreement with the diffraction pattern of an opaque nucleus. The energy spectrum of the scattered pions shows that the major part of the inelastic scattering between 60 and 180° is due to the collisions of the incoming pions with single nucleons in the nucleus. (auth)

3820

μ-PAIR PRODUCTION IN NUCLEI BY GAMMA RAYS. L. M. Afrikian (Academy of Sciences, Armenian, SSR). Soviet Phys. JETP 4, 933-4(1957) July.

3821

INELASTIC SCATTERING OF 160 Mev PIONS ON EMULSION NUCLEI. B. A. Nikol'skii, L. P. Kudrin, and S. A. Ali-Zade. Soviet Phys. JETP 5, 93-101(1957) Aug.

The angular and energy spectra of pions inelastically scattered on photographic emulsion nuclei have been obtained. The average energy of pions scattered backwards ($\theta \geq 90°$) was found to be 64.2 ± 3 Mev. Inelastic scattering of 160 Mev negative pions on emulsion nuclei was calculated by the Monte Carlo method on the assumption that the picture of individual meson-nucleon collisions is valid. The problem of the sensitivity of the results obtained to the assumed characteristics of the interaction of pions with the nucleus is considered in detail. By comparing the calculated results with the experimental data, the average potential energy of the interaction of the pion with the nucleus was determined at $E_\pi = 160$ Mev as $V = -(24 \pm 6)$ Mev. (auth)

3822

ON THE PROBLEM OF K^0 DECAYS. I. Iu. Kobzarev. Soviet Phys. JETP 5, 125(1957) Aug.

One possibility for an experimental test of the hypothesis of nonconservation of parity in the decay of the K^0 meson is pointed out. (L.T.W.)

3823

ON THE QUESTION OF THE SPIN AND PARITY OF THE τ-MESON. I. S. Shapiro, E. I. Dolinskii, and A. P. Mishakova (Moscow State Univ.). Soviet Phys. JETP 5, 129-30(1957) Aug.

A comparison of the experimental data on the energy spectrum and angular distribution of the π mesons formed in positive and negative τ decay with theoretical curves leads to the conclusion that the most probable spin and parity values for the meson are 0^-. (L.T.W.)

3824

SCATTERING OF π-MESONS ON NUCLEONS IN HIGHER APPROXIMATIONS OF THE TAMM-DANCOFF METHOD. Iu. M. Popov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 131-3(1957) Aug.

3825

SCATTERING OF K MESONS WITH CHANGE OF INTRINSIC PARITY. V. B. Berestetskii and Iu. A. Bychkov. Soviet Phys. JETP 5, 150-1(1957) Aug.

3826

A PHYSICAL MODEL OF THE HYPERON. G. D'erdi (Gyorgi) (Central Physical Research Inst., Budapest). Soviet Phys. JETP 5, 152-4(1957) Aug.

3827

ELASTIC SCATTERING OF π^+ MESONS ON NUCLEI AT ENERGIES OF 300 MEV. M. S. Kozodaev, R. M. Sulyaev et al. (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 1047-9(1957) Oct. (In Russian)

The elastic scattering of π^- and π^+ mesons on He nuclei at energies near 300 Mev was studied to determine the angular distribution and to check the importance of Coulomb effect interference. (R.V.J.)

3828
ON THE PHOTOPRODUCTION OF STRANGE PARTICLES. S. G. Matinyan (Inst. of Physics, Acad. of Sciences Georgian S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1063-4 (1957) Oct. (In Russian)

Neutrons

3829 LA-756(Del.)
Los Alamos Scientific Lab., N. Mex.
THE SERBER-WILSON METHOD FORMULAE AND COMPUTATION METHODS. Bengt Carlson. Jan. 17, 1950. Decl. with deletions Mar. 29, 1957. 17p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

A discussion of the mathematical applications of the Serber-Wilson method, restricted to the one-velocity neutron diffusion model with isotropic scattering and to spherical configurations consisting of concentric media, is presented. (auth)

3830 LA-1997
Los Alamos Scientific Lab., N. Mex.
MASS YIELDS FROM FISSION BY NEUTRONS BETWEEN THERMAL AND 14.7 MEV. George P. Ford, James S. Gilmore, D. P. Ames, J. P. Balagna, J. W. Barnes, A. A. Comstock, G. A. Cowan, P. B. Elkin, D. C. Hoffman, G. W. Knobeloch, E. J. Lang, M. A. Melnick, C. O. Minkkinen, B. D. Pollock, J. E. Sattizahn, C. W. Stanley, and B. Warren. Feb. 1956. Decl. Dec. 17, 1957. 20p. Contract W-7405-eng-36. $0.75(OTS).

Radiochemically determined mass-yield curves are given for the fission of U^{235} and U^{238} by 14.7-Mev neutrons. Symmetric and to a less extent, very asymmetric modes of fission are more probable at that energy than in thermal fission. Yields of four fission products from the fission of U^{235} have been measured as a function of neutron energy in the range thermal to 14 Mev. The yields of eleven masses have been measured from the fission of Np^{237} by degraded fission spectrum neutrons. The mass-yield curve is similar to that from the thermal fission of Pu^{239} with a ratio of peak to valley yields of approximately 175. Relative yields of one peak fission product and four valley fission products have been determined under the following conditions: fission of U^{235} and Pu^{239} with thermal neutrons; fission of U^{235}, Pu^{239} and U^{238} with fission spectrum neutrons; and fission of U^{235} and Pu^{239} with the intermediate neutron spectrum at the center of the Los Alamos Fast Reactor. Absolute yields of Mo^{99} have been determined from the fission of U^{233}, U^{235}, and Pu^{239} with thermal neutrons. (auth)

3831 NDA-56-2
Nuclear Development Corp. of America, White Plains, N. Y.
A PROPOSED EXPERIMENT TO STUDY THE PRODUCTION OF GAMMA RADIATION BY EPITHERMAL NEUTRON CAPTURE. Phillip S. Mittelman and Sidney Liebson. Feb. 8, 1956. 7p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract AT-29. $1.80(ph OTS); $1.80(mf OTS).

The possibility exists that epithermal neutron capture in heavy shielding materials or structural materials constitutes an important gamma ray source. An experiment is proposed which will measure the high energy gamma rays resulting from the exposure of the material in question to the neutrons from a Po–Be source (moderated by borated water). A feasibility study indicates that lead can be studied with available neutron sources and reasonable counting times. (auth)

3832 WAPD-TM-91
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
NEUTRON FLUX MAPPING BY LARGE DETECTORS. D. R. Harris. Oct. 1957. 9p. Contract AT-11-1-GEN-14. $0.50(OTS).

3833
YIELD OF NEUTRONS FROM VARIOUS RADON SOURCES Rn + B, Rn + C, Rn + CaF_2, Rn + Mg, Rn + Al, Rn + Si, Rn + SiO_2, AND Rn + GRANITE. G. V. Gorshkov and V. I. Matvienko (Khlopin Radium Inst. Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 211-12(1957) Sept. 11. (In Russian)

Nuclear Physics

3834 HW-51983
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT [FOR] APRIL, MAY, JUNE 1957. Aug. 14, 1957. 81p. Contract W-31-109-Eng-52. $2.00(OTS).

Equations are developed which describe the neutron flux in a nonabsorbing heavy gas medium with a temperature discontinuity. Neutron diffusion lengths in Hanford reactor graphite were re-evaluated using more accurate cross section values and allowing for the effect of nitrogen in the graphite pores. Equations are developed which show that there is no energy spectrum for a point source neutron emitter which leads to a Maxwellian flux distribution everywhere in a general scattering medium at temperature T. Theoretical calculations of critical buckling were made for solid fuel elements of 3% enrichment in H_2O. The addition of soluble poisons was considered as a method of circumventing the criticality problems associated with the processing of enriched U. B/U^{238} ratios required to maintain a $k_\infty < 1$ in 3% U^{235} homogeneous systems with H/U^{238} ratios from 2 to 100 were determined. Semi-empirical modifications of age theory were made to estimate criticality conditions for slightly enriched U solutions. Enrichments in the range 0.95 to 4.9% and H/U^{235} ratios from 10 to 10^4 were considered. Total and fission cross section measurements of the 1 ev resonance in Pu^{240} were made with the crystal spectrometer. Resonance width values $\Gamma = 32.2 \pm 1.5$ mv and $\Gamma_f = 6.1 \times 10^{-3}$ mv were obtained. Measurements of the variation of graphite diffusion lengths with temperature were completed. Buckling measurements were made on several lattices of natural U slugs in graphite and 1.466% enriched slugs in H_2O. Preliminary data are reported from measurements of k_∞ for UO_2 cluster lattices in D_2O. Descriptions of the measurements are included. Measurements of k_∞ were made for three fuel configurations in a $2\frac{1}{8}$-in. process tube as a function of the graphite to U ratio. (For preceding period see HW-50598.) (D.E.B.)

3835 PR-P-35
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
PHYSICS DIVISION PROGRESS REPORT [FOR] JULY 1, 1957 TO SEPTEMBER 30, 1957. 73p. (AECL-517).

Numerical integrations of the partial nuclear radiation widths were done over all transitions using a new level spacing formula. The ratio of observed to computed widths peak at A = 75, 110, and 160. Studies of longitudinal polarization of β rays from Y^{90} and Au^{198} were made using the Møller scattering technique. Least-squares calculations were carried out to determine the characteristics of U^{236} and Cf^{252} emission spectra. Values of α, T_1, and T_2 are given. Studies directed toward the identification of energy

levels and spin states in the reaction $F^{19}(p,\gamma)Ni^{20}$ are reviewed. Gamma-ray branching of the 15.1 Mev level in C^{12} was remeasured using new techniques and with better statistics. Further data were obtained on the energy levels in F^{19} from the reactions $O^{16}(He^3,p)F^{18}$ and $N^{14}(\alpha,\gamma)F^{18}$. New measurements of the properties of the second excited state in P^{31} are reported which are in better agreement with the theory of the sequence of spin and parity values. The transmission cross section for liquid Ne was measured using 1.064 A neutrons. The Ta^{182} gamma spectrum was examined between 6.5 and 2.9 Mev with the pair spectrometer and between 3 and 0.09 Mev with the flat crystal spectrometer. Preliminary values for the strongest observed gamma rays are given. The mosaics of two Ge and one quartz crystal were measured and compared with the mosaic of the calcite crystal presently used in the crystal spectrometer. The overshoot phenomenon observed in tritium monitor response was cleared up by improved methods of sealing the chambers against air leakage. The Born-Green theory was used to extrapolate the measured neutron scattering from Ar. A general expression was derived for the angular distributions of electrons and of neutrinos and the polarization of electrons for the β-decay of an oriented nucleus in a transition of arbitrary forbiddenness. A new and more reasonable study of the resonance theory analysis of U^{235} cross sections was begun. Progress in the design, development, and construction of radiation detection equipment is reviewed. (For preceding period see PR-P-34.) (D.E.B.)

3836

PROBLEMS POSED BY THE CAUSAL INTERPRETATION OF THE HYDRODYNAMIC PAULI EQUATION. Pierre Hillion. Compt. rend. 245, 1703-5(1957) Nov. 13. (In French)

The outline of the causal interpretation is studied regarding the problem of radiation of the electron as well as the mechanism of absorption and emission of energy. (tr-auth)

3837

SPINS AND PARITIES OF HYPERFRAGMENT H^4_Λ AND K MESON. Chzhou Guan-chzhao and M. I. Shirokov (Joint Inst. of Nuclear Research). Eksptl'. i Teoret. Fiz. 33, 1072-3(1957) Oct. (In Russian)

Analysis is given of angular correlation in the cascades $\pi^- + He^4 \rightarrow H^4_\Lambda + K$, $H^4_\Lambda \rightarrow He^4 + \pi$, $K \rightarrow \pi + \pi$, $K^- + He^4 \rightarrow H^4_\Lambda + \pi$, and $H^4_\Lambda \rightarrow He^4 + \pi$ for H^4_Λ and K of various spins and parities. (R.V.J.)

3838

SOLUTION OF THE RADIAL SCHRÖDINGER EQUATION FOR ARBITRARY SPIN. Bruno Bürgel. Helv. Phys. Acta 30, 395-406(1957). (In German)

3839

COMMENT ON THE CTP THEOREM. Res Jost. Helv. Phys. Acta 30, 409-16(1957). (In German)

This theorem plays a part in recent discussions of nonconservation of parity. It states that in local field theory, if only the true relation between spin and statistics holds, from the invariance in relation to the inhomogeneous, orthochronic Lorentz group without homologous relation, the invariance connected with the product of charge conjugation (C) and the simultaneous inversion of 4 composite coordinates (TP) results. An attempt is made to explain this remarkable theory on the basis of quantized field theory. (tr-auth)

3840

NON-RELATIVISTIC LIMIT OF A BETHE-SALPETER EQUATION. G. Wanders. Helv. Phys. Acta 30, 417-46 (1957). (In French)

A bound state of two scalar particles with mass m is described relativistically by a wave function $\Phi(x_1, x_2)$, which is a solution of a Bethe-Salpeter equation. The "ladder approximation" of this equation has been discussed quite completely, in the special case of scalar photons as binding due to scalar mesons, with nonvanishing mass μ is presented. (auth)

3841

A STUDY OF TWO BRANCH STARS. M. di Corato, C. Dilworth, D. Hirschberg, L. Hirschberg, L. Scarsi, P. Solari, and G. Tomasini. Nuovo cimento (10) 4, Suppl. No. 2, 490-6(1956).

2385 two-branch stars were found in 37 cm^3 of emulsion of the stacks No. 31 and No. 9 of the Sardinia flights 1953. 2195 of these stars were investigated and classified. The 195 stars not classified were too steeply dipping to allow even their rough classification in the 6 main classes. All stars in which there was a visible recoil or slow electron were eliminated from the statistics. (auth)

3842

THE PENETRATION OF THE DIFFUSE NUCLEAR POTENTIAL BARRIER. Ken Kikuchi (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 17, 643-50(1957) May.

The effect of the diffuse nuclear potential on the penetration of the potential barrier is examined using a simplified model. The transmission coefficient for slow neutrons is treated in an exact way employing an exponential diffuse potential and is found to be larger by a factor 2 than in the usual calculation. The Coulomb penetrability is investigated on the basis of the W-K-B method, and the diffuseness makes the penetration factor much larger than that obtained in the conventional calculation. An application to the evaporation process is developed, and the energy spectrum of α particles from the $Al^{27}(n,\alpha)Na^{24}$ reaction is found to be explained by the corrected penetrability in a satisfactory way. (auth)

3843

SOME REMARKS ON THE CHARGED MESIC DECAY OF $^3H_\Lambda$. T. Ogimoto (Osaka Univ.) and Y. Yamaguchi (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 17, 817-19 (1957) June.

3844

HEAVY NUCLEAR FRAGMENTS FROM DISINTEGRATION PRODUCED BY FAST PROTONS IN NUCLEAR EMULSIONS. O. V. Lozhkin and N. A. Perfilov (Radium Inst. of the Academy of Science, USSR). Soviet Phys. JETP 4, 790-8(1957) July.

Fine-grain type P-9 nuclear emulsions have been used for the study of that interaction process of 350 to 660 Mev protons with the nuclei of the emulsion which leads to the formation of multiple-charge particles with $Z \geq 4$. It has been observed that the production of multiple-charge particles of high energy (E_{kin} per nucleon > 3 to 4 Mev) takes place on the light nuclei of the emulsion (C, N, O) as well as on the heavy ones (Ag, Br). The main characteristics of the nuclear fragment disintegration have been investigated. The analysis shows that—to explain the formation of fragments—one has to assume a series of specific properties of primary interactions of fast protons with nuclei. (auth)

3845

NUCLEAR DISINTEGRATIONS PRODUCED BY 660 Mev PROTONS IN PHOTOGRAPHIC EMULSIONS. E. L. Grigor'ev and L. P. Solov'eva (Academy of Sciences, USSR). Soviet Phys. JETP 4, 801-6(1957) July.

Experimental material is presented from an investigation of nuclear disintegrations produced in photographic emulsion by 660-Mev protons. The general features of the disintegration, the magnitude of the cross section for

inelastic processes, and the distributions in energy and angle of secondary protons and alpha particles are presented. The yield of charged π mesons per disintegration is obtained, and an approximate value is suggested for the lower limit of the cross section for emission of two charged π mesons in a disintegration. (auth)

3846
INTERNAL BREMSSTRAHLUNG IN ELECTRIC MONOPOLE $0^+ \rightarrow 0^+$ NUCLEAR TRANSITIONS. Iu. V. Orlov (Moscow State Univ.). Soviet Phys. JETP 4, 944-5(1957) July.

The results of calculations of the relative probability of internal bremsstrahlung emitted by the components of a pair in $0^+ \rightarrow 0^+$ nuclear transition are given. The calculation is done to the Born approximation and is therefore applicable only to light nuclei. (L.T.W.)

3847
ON A METHOD OF DIRECT COMPUTATION OF THE NUCLEON-NUCLEON INTERACTION ON THE BASIS OF EXPERIMENTAL VALUES FOR THE LEVELS OF LIGHT NUCLEI. Iu. M. Shirokov, V. V. Balashov, and K. A. Tumanov (Moscow State Univ.). Soviet Phys. JETP 5, 136-8(1957) Aug.

A method is given for the study of the nucleon-nucleon interaction in nuclei based on the assumptions that the forces in the nucleus act between pairs of nucleons and the mean velocity of a nucleon in the nucleus is of the order of 0.1c or less. (L.T.W.)

3848
ON THE STRUCTURE OF NUCLEONS. I. E. Tamm (Academy of Sciences, USSR). Soviet Phys. JETP 5, 154-5 (1957) Aug.

Comparison of the results of measurements of the scattering of fast electrons (with energy up to 550 Mev) by protons with measurements of the interaction of electrons with neutrons has led to conclusions that these data as a whole are in contradiction either with the charge independence of the interaction of mesons with nucleons, or with the foundations of quantum electrodynamics. This note presents arguments against the legitimacy of these conclusions. (L.T.W.)

3849
A NEW POSSIBILITY IN NEUTRINO THEORY. A. M. Brodskii and D. D. Ivanenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 910-12(1957) Oct. (In Russian)

In addition to the usual description of electrons and other fermions by means of second type spinors, it is suggested that, for the neutrino, use can be made of Cartan spinors of the first type with other transformation laws in reflection. Despite the conservation of parity, a number of conclusions of such a theory are analogous to the Yang-Lee theory. (tr-auth)

3850
RELATION BETWEEN «PARTICLE» AND «HOLE» MATRIX ELEMENTS IN THE NUCLEAR SHELL THEORY. V. G. Neudachin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 918-22(1957) Oct. (In Russian)

The relation between the matrix elements for particle configurations and hole configurations is considered for pair operations—noncentral interactions of the general type. The following particular cases are considered: central, tensor, and spin-orbital forces. The connection between single particle operator matrix elements is briefly discussed. (tr-auth)

3851
THE TIME REVERSAL AND REACTIONS INVOLVING POLARIZED PARTICLES. M. I. Shirokov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 975-81(1957) Oct. (In Russian)

If the interaction between the particles in the reactions $a + b \rightleftharpoons c + d$ is invariant under the time reversal, it is possible to obtain certain relations connecting the angular distribution, polarization vectors and tensors of the particles a, b, c, d, in the direct and inverse reactions (the spins of the particles being arbitrary). These relations can be considered as the generalization of the so-called detailed balance principle. (tr-auth)

3852
ON THE ABSOLUTE VALUE OF THE STRIPPING CROSS SECTION AND CROSS SECTION FOR DIFFRACTION SCATTERING OF THE DEUTERON. I. I. Ivanchik (Academy of Sciences, USSR). Soviet Phys. JETP 5, 133-4 (1957) Aug.

Nuclear Properties

3853 AECD-4256
[Los Alamos Scientific Lab., N. Mex.].
NEUTRON-INDUCED FISSION CROSS SECTION OF Pu^{240}. R. L. Henkel, R. A. Nobles, and R. K. Smith. [Feb. 1957]. Decl. Mar. 15, 1957. 2p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

The fission cross section of Pu^{240} was determined from Pu^{240}/U^{235} ratio for neutron energies between threshold and 8.1 Mev. U^{235} cross section values were essentially those given in a recent compilation in "Progress in Nuclear Energy." The technique used was to mount the two foils back-to-back in a double ionization chamber and to irradiate them in a neutron flux of variable energy. (A.C.)

3854 AECL-457
DECAY SCHEMES OF RADIOACTIVE ISOTOPES. V. S. Dzelepov and L. K. Peker. Translated from a publication of the Academy of Sciences, U.S.S.R., Moscow—Leningrad, 1957. 176p.

Available data on the decay characteristics of nuclei having mass numbers between 1 and 253 were compiled, and decay schemes are presented. Decay schemes for the related disintegrations of different isotopes with the same mass number are shown in a single figure for convenience in the study of nuclear structure. However, in heavy nuclei where α disintegration may occur, this convention is assumed only as a starting point for a method of representation. All numerical data are exhibited directly in the decay schemes. Both the decay schemes and numerical data were taken from the most reliable data published prior to May, 1956. (D.E.B.)

3855 NP-6504
California. Univ., Berkeley.
NUCLEAR SCATTERING OF NUCLEONS AND ANTINUCLEONS. Technical Report No. 8. Hans-Peter Duerr. [1957]. 21p. Contract DA-04-200-ord-171, T. O. 11.

Total cross sections and reaction cross sections for scattering of nucleons and antinucleons from nuclei are calculated in the WKB approximation. The real part of the potential is the effective potential of the relativistic theory proposed in earlier papers, with a radial dependence consistent with the electron scattering results. The absorption coefficient is related to the observed particle-particle cross sections in the usual fashion. The resulting cross sections for nucleons agree quite well with the experimental data up to approximately 250 Mev. However, the high energy nucleon total cross section and the antinucleon cross sections are too large. This discrepancy presents a real difficulty for the relativistic theory. (auth)

3856 UCRL-3901

California. Univ., Berkeley. Radiation Lab.

GAMMA TRANSITIONS FROM THE 15-MEV LEVEL IN CARBON-12 (thesis). Charles N. Waddell. Aug. 13, 1957. 91p. Contract W-7405-eng-48. $15.30(ph OTS); $5.40 (mf OTS).

The radiative transitions from the 15.1-Mev T = 1 level of C^{12} have been observed with a pair spectrometer and a NaI(Tl) crystal. The spectrum measured at 80° with respect to the direction of a 31-Mev proton beam incident on a thick C target shows γ rays of 15.1, 12.8, and 10.7 Mev with relative intensities of 1 : 0.090 ± 0.015 : 0.095 ± 0.014. The 10.7-Mev γ ray results from the transition to the first excited state of C^{12} and the 12.8 ± 0.2-Mev γ ray can be identified as the ground-state transition from the 12.76-Mev level of C^{12}. The excitation function for the production of the 15.1-Mev level by the inelastic scattering of protons has been measured from threshold to 340 Mev. The variation in yield near threshold is consistent with that expected from penetration of the Coulomb barrier by l = 0 outgoing protons. The variation in yield for higher-energy protons (~60 to 340 Mev) is in agreement with calculations based on the assumption of excitation through the collision of the incoming proton with a nucleon within the entire volume of a spherical nucleus. The relative intensity of 15.1-Mev and 4.43-Mev γ rays obtained in reactions inhibited by the conservation of isotopic spin has been compared with the relative intensity obtained in allowed reactions. In each of the allowed reactions $-C^{12}(p,p')C^{12*}$, $C^{12}(n,n')C^{12*}$, $B^{11}(d,n)C^{12*}$, $Be^{9}(\alpha,n)C^{12*}$ –there was an observable yield of 15.1-Mev γ rays. In the forbidden reactions $-C^{12}(d,d')C^{12*}$, $C^{12}(\alpha,\alpha')C^{12*}$ –there was no observable yield until the energies of the incoming particles were sufficiently high to permit breakup of the outgoing particles. The measurements indicate that mixing of isotopic spins in the first T = 1 level is comparable to the mixing expected for the ground state. (auth)

3857

NEUTRON CAPTURE GAMMA RAYS FROM LITHIUM, BORON, AND NITROGEN. G. A. Bartholomew and P. J. Campion (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Can. J. Phys. 35, 1347-60(1957) Dec.

The neutron capture γ rays from Li^{7}, B^{11}, and N^{15} have been studied. In Li^{7} γ rays are observed at 7.26 ± 0.03 Mev and 6.78 ± 0.05 Mev. In B^{11} six γ rays are detected. The spectrum is consistent with J = 7/2 + for the capturing state. In N^{15} six previously unreported γ rays are detected. Estimates of thermal neutron radiative capture cross sections are Li^{6}, 0.028 ± 0.008 b; B^{10}, 0.5 ± 0.2 b; and N^{14}, 0.08 ± 0.02 b. (auth)

3858

NEUTRON CAPTURE GAMMA RAYS FROM FLUORINE, MAGNESIUM, GALLIUM, BROMINE, AND HAFNIUM. P. J. Campion and G. A. Bartholomew (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Can. J. Phys. 35, 1361-79(1957) Dec.

The neutron capture γ ray spectra of fluorine, magnesium, gallium, bromine, and hafnium have been studied in the energy range above 3 Mev. In fluorine four γ rays and in magnesium 12 γ rays have been detected in addition to those previously observed. Most of these new radiations can be assigned to the known level schemes of the product nuclei. The spectrum obtained for each of the other elements is complex with only a few of the high energy γ rays resolved, and in each case the γ ray of highest energy is very weak and difficult to distinguish from the background. The most energetic gallium γ ray at 7.73 ± 0.02 Mev may be emitted in the direct ground state transition in Ga^{70} while the 7.879 ± 0.013 Mev γ ray from bromine probably corresponds to the ground state transition in Br^{80}. In hafnium none of the observed γ rays can be identified with a ground state transition in any of the isotopes. (auth)

3859

ALPHA-GAMMA ANGULAR CORRELATION IN Pu^{239}. Georges-Yves Petit. Compt. rend. 245, 1916-18(1957) Nov. 25. (In French)

An experiment with angular correlation between the alpha particles of Pu^{239} and the gamma radiation of the 51 kev excited state of U^{235} gave some results in agreement with the decay scheme for Pu^{239} involving the cascade of spins and particles $\frac{1}{2} + \frac{a}{} \frac{5}{2} + \frac{L}{} \frac{1}{2} +$ the final state, this being the metastable state of U^{235}. (tr-auth)

3860

MEASUREMENTS OF THE EFFECTIVE RESONANCE INTEGRAL IN URANIUM METAL AND OXIDE IN DIFFERENT GEOMETRIES. Eric Hellstrand (AB Atomenergi, Stockholm, Sweden). J. Appl. Phys. 28, 1493-1502(1957) Dec.

A series of measurements of the effective resonance integral in uranium metal and oxide, UO_2, has been made. Measurements were performed on simple rods, on a few tubes, empty or filled with a moderator, and on clusters of rods. Formulas for the effective resonance integral as a function of S/M and $(S/M)^{\frac{1}{2}}$ are given for metal and UO_2. In addition the variation of the resonance absorption of neutrons as a function of depth in metal rods has been studied. The results are given in the form of curves. (auth)

3861

THE DEPENDENCE OF PAIR FORMATION CROSS SECTIONS ON ATOMIC NUMBER. Wolfgang Schikarski. Z. angew. Phys. 9, 541-7(1957) Nov. (In German)

3862

ON THE ENERGY LEVELS OF NUCLEONS IN SPHEROIDAL NUCLEI. D. A. Zaikin (Lebedev Inst. of Physics, Acad. of Sciences U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1049-57(1957) Oct. (In Russian)

A method was developed for obtaining spectra of high energy particles in an ellipsoidal well. The method can also be used for any type of deformation except the minute vanishing ones. (R.V.J.)

3863

ASYMPTOTIC SELECTION RULES IN β DECAY OF DEFORMED NUCLEI. M. E. Voikhanskii (Gertsen Leningrad Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1054-6(1957) Oct. (In Russian)

A series of selection rules was developed for β transitions of arbitrary order of forbiddenness in various types of interactions. (R.V.J.)

3864

COMPARISON OF NEUTRON FISSION SPECTRA OF U^{233}, U^{235}, AND Pu^{239}. V. P. Kovalev, V. N. Andreev, et al. Zhur. Eksptl'. i Teoret. Fiz. 33, 1069-71(1957) Oct. (In Russian)

Results indicate that U^{233} and Pu^{239} neutron fission spectra are harder than the spectrum of U^{235}. Evaluations of the temperature rise in U^{233} fission fragments compared to U^{235} equals 0.04 ± 0.01 and 0.05 ± 0.01 Mev. (R.V.J.)

Nuclear Reactors

3865 AECU-3601

General Electric Co., Schenectady, N. Y.

NON-SYMMETRICAL MAIN COOLANT SYSTEM ANALYSIS (NOMACS). PART I. R. C. Larsen. Sept. 11, 1957. 45p. (DF-57-AD-30). $7.80(ph OTS); $3.30(mf OTS).

Non-symmetrical main coolant system analysis is an

IBM-704 digital program for calculating the reactor generation, primary coolant temperature distribution, and steam temperature, pressure, and flow to the main and auxiliary turbines during a transient period. The program represents a system composed of a two-pass high pressure water cooled reactor with two main primary coolant loops each having its own steam generator, separator, and drum. The generated steam from each loop is piped into a common header which is then piped to the main and auxiliary turbines and other steam loads in the system. The mathematical representation for solution is described. (M.H.R.)

3866 ANL-5514(Del.)
Argonne National Lab., Lemont, Ill.
REACTOR DEVELOPMENT QUARTERLY PROGRESS REPORT. 4000 PROGRAM. Stuart McLain, comp. Oct. 31, 1955. Decl. Nov. 18, 1957. 50p. Contract W-31-109-eng-52. $0.45(OTS).

The status of Experimental Boiling Water Reactor development is reviewed. Shell testing, control mechanism development, fuel corrosion, and dimensional stability studies, and design consideration to facilitate D_2O operation are discussed. Fuel plate and subassembly fabrication, corrosion, and radiation damage studies were continued. Reactor water filtration, purification, and induced activity are considered. High-temperature operational tests were run on Experimental Breeder Reactor mechanisms. Though several minor malfunctions were encountered, the basic operation is considered satisfactory. Studies of the physical and metallurgical properties of U – Mo, U – Zr, U – Pu, and U – Pu – Mo alloys for fuel elements were conducted. Conversion ratio determination for the second loading of EBR-I gave a value of 1.03 ± 0.05. Alloys and systems were irradiated and the effects of the irradiation on corrosion determined. Included in the irradiation were U, U – Si, Nb – Sn, UO_2, and Al – Ni. (For preceding period see ANL-5476.) (D.E.B.)

3867 ANL-5768
Argonne National Lab., Lemont, Ill.
DESIGN AND PERFORMANCE CHARACTERISTICS OF MAGNETIC JACK-TYPE CONTROL ROD DRIVE. Joseph N. Young. Dec. 1957. 80p. Contract W-31-109-eng-38. $2.50(OTS).

The magnetic jack is a hermetically sealed, step-motion linear motor which satisfies the need for a reliable, low-cost, nuclear reactor control rod drive. It is especially applicable for operation under adverse conditions peculiar to pressurized water-cooled reactors. The jack consists of a pressure shell, four sets of external magnet coils, and one internal moving part which imparts linear motion to rod extensions of the control rod. The desired motion is achieved by energizing and de-energizing the various coils in a given sequence. An electromagnetic position indicator registers the position of the drive rods, thereby locating the position of the control rod in the reactor core. Two magnetic jacks were operated under simulated boiling water reactor operating conditions for 3150 hours (18,300 ft total rod travel, 2210 scrams) and 1330 hours (7,700 ft total rod travel, 1000 scrams), respectively. There were no mechanical malfunctions and no significant wear was observed on the components. The position of the rod was indicated to an accuracy of 0.05 in. Complementary information includes detailed formulas and work sheets for calculating magnetic circuits and component drawings for two alternate magnetic jack designs. (auth)

3868 APAE-7(Del.)
Alco Products, Inc., Schenectady, N. Y.
REACTOR ANALYSIS FOR ARMY PACKAGE POWER REACTOR NO. 1. J. G. Gallagher, ed. May 29, 1956. Decl. with deletions Feb. 22, 1957. 140p. Contract AT(11-1)-318. $21.30(ph OTS); $6.90(mf OTS).

The reactor analysis of the critical experiment and the APPR-1 resulted in a loading of the APPR-1 of 21.098 g of B^{10} with 22.5 kg U^{235}. This loading will result in adequate reactivity for a core life of 13 Mwyr based on uniform burnup of U^{235} and B^{10}. Calculations indicate that five of the seven control rods provided are more than adequate to shut the reactor down at any time. The temperature coefficient of reactivity should be at least -2×10^{-4} $\Delta k/°F$. (auth)

3869 APAE-Memo-106
Alco Products, Inc.
CONTROL ROD DRIVE DEVELOPMENT. J. P. Tully, T. F. Connolly, and R. E. Anderson. Aug. 15, 1957. 75p. Contract AT(11-1)-318. $12.30(ph OTS); $4.50(mf OTS).

Equipment and procedures used in testing Army Package Power Reactor control rod drive mechanisms are described. Photographs of mechanism components taken before and after testing are included. (D.E.B.)

3870 BNL-2913
Brookhaven National Lab., Upton, N. Y.
REACTIONS BETWEEN LMFR FUEL AND ITS CONTAINER MATERIALS. Metallurgy Memo No. 586. W. E. Miller and J. R. Weeks. May 4, 1956. Decl. Apr. 12, 1957. 34p. $1.00(OTS).

The most practical container materials from the corrosion resistance, mechanical properties, and heat transfer considerations, are the steels. Experiments were performed to study the problem of carbide formation by U and/or fission products in the Bi reacting with the graphite moderator in a thermal reactor. Since Zr has little effect on the rate of solution of Fe in Bi, and an appreciable effect on the rate of solution of Fe from steels, experiments were run to determine the nature of the surface deposit formed on the steels. Results from these experiments are described. (M.H.R.)

3871 CERD-0005-RS-5
Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn.
SUMMARY OF PROGRESS IN REACTOR TECHNOLOGY. J. P. Davis, J. M. Stein, and H. A. Viewig. June 14, 1957. 18p. $3.30(ph OTS); $2.40(mf OTS).

Methods for determining flux depression into the surface of an absorber and the self-shielding within an absorber are presented. An equation is given for evaluating dose rates from coolant activation is pressurized water reactors. A fast neutron dose attenuation kernel for a point source of fission neutrons in water was found using the Boltzmann transport equation. Analytical studies of corrosion product activation and transport in pressurized water are reviewed. (D.E.B.)

3872 CF-52-4-197(Rev.)
Oak Ridge National Lab., Tenn. and Division of Reactor Development, AEC.
PROCEEDINGS OF THE SECOND FLUID FUELS DEVELOPMENT CONFERENCE [HELD AT] OAK RIDGE NATIONAL LABORATORY ON APRIL 17 and 18, 1952. Decl. Apr. 8, 1957. 438p. $1.85(OTS).

Papers on the chemistry, metallurgy, physics, and engineering of homogeneous reactor design and operation are included. (D.E.B.)

3873 CF-54-12-120
Oak Ridge National Lab., Tenn.
THE AMOUNT OF Na^{22} IN THE Na COOLANT OF THE ARE AFTER OPERATION AT 2 Mw FOR TWO DAYS. H. W. Bertini. Dec. 23, 1954. Decl. July 5, 1957. 3p.

Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

3874 CF-57-7-105
Oak Ridge National Lab., Tenn.
A CALCULATION OF THE GAMMA-RAY SPECTRUM OF THE BULK SHIELDING REACTOR. Gerard deSaussure. July 31, 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

A calculation was performed to determine the high-energy portion of the gamma-ray flux at the surface of the uranium–aluminum BSF reactor. The flux was considered to consist entirely of the uncollided flux plus the Compton-scattered flux. The four sources of primary gamma rays included in the calculation were prompt fission gamma rays, capture gamma rays from aluminum, capture gamma rays from uranium, and fission-product decay gamma rays. These sources were divided into four energy groups. Although the assumptions used to calculate the Compton-scattered flux tended to over-estimate the actual spectrum, the calculated results were considerably lower than a previously measured spectrum. (auth)

3875 CF-57-11-32
Oak Ridge National Lab., Tenn.
CHANGE IN CRITICAL CONCENTRATION IN A CYLINDRICAL REACTOR DUE TO A LONGITUDINAL HOLE. M. Tobias. Nov. 8, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The change in critical concentration due to axial holes of various diameters in a right circular cylinder containing D_2O and pure U^{233} or U^{235} is discussed. This geometry is intended to represent an aqueous homogeneous reactor with a central void due to rotating flow of the fluid through the core. The critical equations and results of calculations are given. (M.H.R.)

3876 CF-57-11-148
Oak Ridge National Lab., Tenn.
INLET NOZZLES FOR SLURRY FOR HRT BLANKET. J. M. Trummel. Nov. 15, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An investigation indicated changing the Homogeneous Reactor Test blanket inlet nozzles for slurry use is feasible. However, a larger head and capacity circulation pump would be required, and it would be necessary to block some of the heat exchanger tubes to assure slurry suspension. A nozzle design and system hydrodynamic values are proposed. (D.E.B.)

3877 CF-57-12-66
Oak Ridge National Lab., Tenn.
STRESSES CAUSED BY INTERNAL PRESSURE AND UNIFORM TEMPERATURE CHANGES IN CLAD SPHERICAL VESSELS. R. D. Cheverton. Dec. 17, 1957. 20p. $3.30(ph OTS); $2.40(mf OTS).

The HRT pressure vessel was used as an example problem. It was determined that the presence of cladding increased the outer vessel stresses by about 30 percent. This seems to be sufficient reason for concluding that cladding in a vessel should be considered, when analyzing the stresses in the vessel. (auth)

3878 CRL-49
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE NRU REACTOR. G. C. Laurence. Nov. 1957. 20p. (AECL-525).

Paper given at the meeting of the American Nuclear Society, New York, Oct. 30, 1957.

NRU is the new high power research reactor at Chalk River. It is designed to provide a high neutron flux in a large core, thus permitting the irradiation of long fuel rods and other large objects, and to have ample facilities for research and irradiation. It is moderated and cooled with D_2O and uses natural U fuel in the form of flat metal bars clad with Al. It was planned for operation at a power of 200 Mw, with a maximum flux in the moderator of about 3×10^{14} n/cm^2/sec, but the design is such that alterations can be made later which would permit operation at higher power and higher neutron flux if desired. The main features of the design are shown and some of the more important dimensions and specifications are listed. Estimated neutron balance data are given. (auth)

3879 CRL-50
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
CANADA'S APPROACH TO THE ECONOMIC FUELLING OF POWER REACTORS. A. J. Mooradian. Nov. 1957. 31p. (AECL-528).

The Canadian approach to power reactors is compared to that of the U. S. and the U. K. The necessity of nuclear power competing with the present low cost of power in Canada is discussed. This necessity gives rise to their choice of natural U, D_2O moderated reactors. The targets costs of nuclear fuel and the factors involved in the costs are discussed in detail. (M.H.R.)

3880 DM-47
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
HIGH BURN-UP FROM FIXED FUEL. W. B. Lewis. Nov. 27, 1957. 29p. (AECL-531).

Envisaging the possibility of economically competitive reactors in which the fuel charge remains fixed for ten years of operation, it is shown that certain design principles offer some hope. Th is the most promising fertile material. The distribution of fissile and fertile material required is radically different from that in natural U reactors. The fertile material should be distributed as homogeneously as practicable throughout the moderator and the initial fissile material should be exposed to a relatively low thermal neutron flux. Employing these principles it appears possible to derive about 1.5 fissions per initial fissile atom without change of the fuel and this would result in a basic fuelling cost of less than 2 mill/kwh. Because of the requirement that the fuel remains fixed for ten years, it seems impractical to rely on fuel sheathing of perfect integrity, and in the interest of high thermal to electrical conversion efficiency, the high temperature gas-cooled type of reactor appears most promising. Neutron wastage will, however, have to be kept low. (auth)

3881 HW-29062
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MONITORING THERMAL AND RESONANCE NEUTRON FLUX. R. E. Heineman. Aug. 17, 1953. Decl. Jan. 9, 1958. 6p. Contract [W-31-109-eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The monitoring of thermal and resonance neutron flux in a thermal reactor having high flux over periods of time from 1 to 12 months using thin Co foils is considered. Special attention is paid to the many correction factors to be applied to the activation data; neutron temperature, effective Cd cutoff energy, burnout of Co^{59} and Co^{60}, and decay of Co^{60}. Results on a homogeneity test of 10 mil, 0.08% Co–Al alloy foils are given. (auth)

3882 IGT-R-20 (Rpt: UNCLASSIFIED)
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
THE COMMISSIONING AND OPERATIONAL EXPERIENCE OF THE CALDER HALL REACTORS. T. N. Marsham. Oct. 1957. 14p.

The initial loading, testing, and operation of the Calder Hall reactors are reviewed and test results are compared with calculated data. (D.E.B.)

3883 KAPL-M-AMS-1
Knolls Atomic Power Lab., Schenectady, N. Y.
SUMMARY OF STR-SAR SYSTEM OPERATING CONDITIONS AND MATERIALS. S. H. Towne. Apr. 15, 1954. Decl. Mar. 9, 1957. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The operating conditions of Submarine Thermal Reactor and Submarine Advanced Reactor main cooling systems and associated subsystems are tabulated and compared for the purpose of determining the feasibility of substituting carbon steel for stainless steel in SAR. (D.E.B.)

3884 KAPL-M-CVM-22
Knolls Atomic Power Lab., Schenectady, N. Y.
REPLACEMENT OF ELECTRICAL HEATERS ON THE SSN575 REACTOR CONTAINER. C. V. Moore and T. O'Regan. Nov. 21, 1956. Includes Appendices A through C. 32p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

The procedures used in replacing forty Calrod tubular electrical heaters in the SSN575 reactor container are described. The conditions of those removed heaters which showed signs of damage due to service are illustrated and their radioactivities are given. (auth)

3885 KAPL-M-EDL-37(Del.)
Knolls Atomic Power Lab., Schenectady, N. Y.
MECHANICAL AND THERMAL TESTS ON MATRIX TUBE STRUCTURE. W. La Force. Nov. 15, 1953. Decl. with deletions Apr. 24, 1957. 27p. Contract W-3[1]-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Power gradients in the reactor assembly produce temperature distributions which induce bowing of the matrix tubes towards the control cylinder. In connection with a proposal to physically restrain the matrix tubes, a series of tests was conducted to substantiate calculations and to life-cycle methods of restraint. A complete description of tests of the selected restraining method is presented in KAPL Memo CVM-12. Two restraining methods were tested. Method I simulated a matrix tube spot-welded to the upper matrix plate. Method II utilized an "egg crate" assembly. Spot-welding the matrix tubes to the upper matrix plate was satisfactory from the standpoint of mechanical strength, but an extensive development program would be required if this method of restraint were employed. Vibration life tests of the "egg crate" assembly indicated that it had sufficient mechanical strength. The thermal bending tests indicated that with an "egg crate" assembly, the maximum deflection obtained in the matrix tube is reduced by a factor of approximately 4 to 1. This is sufficient to insure that the outer matrix tubes will not contact the control cylinders during reactor operation. The thermal cycle life test of the 24-tube matrix section mockup with "egg crate" assembly gave no evidence of failure after 25,400 cycles. (auth)

3886 KAPL-M-EDL-65
Knolls Atomic Power Lab., Schenectady, N. Y.
S1G ROTATING PLUGS TEST. R. A. Jacoby and A. P. Kokosa. Feb. 21, 1956. 159p. Contract [W-31-109-Eng-52]. $24.30(ph OTS); $7.50(mf OTS).

The mechanical and heat transfer characteristics of the Mark A rotating plugs were investigated. The tests were conducted with static Na and without radioactivity. The results of the testing program indicated the desirability of improvement in the heat transfer characteristics and in sealing of the plugs. The need was also pointed up for improvement of the rotational characteristics that simulate the refueling operation of the rotating plugs. Developmental work was accomplished and the heat transfer, sealing, and rotational characteristics were improved. (auth)

3887 KAPL-M-EDL-81
Knolls Atomic Power Lab., Schenectady, N. Y.
SIR MARK A REACTOR CONTROL CYCLINDER. ACTUATOR PLUG AND QUICK DISCONNECT ASSEMBLY. Interim Report [for] Period Ending December 1, 1954. Series I Test, Fixture No. 2. P. E. Bissonnette, M. A. Colapinto, and J. A. McBride. Dec. 1, 1954. Decl. Apr. 25, 1957. 62p. Contract W-31-109-Eng-52. $10.80 (ph OTS); $3.90(mf OTS).

Interim report is made on the fourth of a series of tests investigating the operating characteristics of the reactor mechanical system components including a SIR Mark A prototype control cylinder, a SIR Mark A quick disconnect unit, and a SIR Mark A control actuator plug. Components were tested, in the Mark A Test Fixture No. 2, in Na, under Mark A reactor conditions in regard to the temperature distribution and system pressure. The performance of components was studied under shim, fine, and scram conditions of control cylinder operation for vertical and tilted attitudes as outlined in the Mark A Control Assembly Test Program. Test components were subjected to 2454 operating cycles totaling 507,888 degrees of control motion of which approximately 98% took place with the fixture in a vertical attitude. This total includes 1500 scram motions. The control elements were in Na for over 5900 hours. Audible vibrations were encountered during testing, but these did not interfere with normal or satisfactory scram operation. Testing results obtained to date indicate the mechanical system components to have performed satisfactorily in accordance with design specifications. (auth)

3888 KAPL-M-GOM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
NEGATIVE REACTIVITY EFFECT OF FUEL ELEMENT EXPANSION ON COLD WATER ACCIDENT. Gerhard O. Mueller. Aug. 20, 1957. 40p. $6.30(ph OTS); $3.00(mf OTS).

The relative effect of fuel element expansion on the power excursion of a pressurized water reactor during a cold water accident was investigated. It is assumed that the inlet temperature wave consists of a 100°F drop occurring at a 1/e rate with a temperature exponential of 0.2 seconds. Control rods are not used, thus reverting all reactor control to the negative temperature coefficient of the core. The approach used to carry out the study is the consecutive solution of the reactor kinetics, heat flow, and reactivity equations. The equation governing heat flow from the clad to the coolant is integrated in two dimensions. The results are in the form of graphical plots of power; fuel, clad, and water temperature; and reactivity versus time. (auth)

3889 KAPL-M-HAF-1
[Knolls Atomic Power Lab., Schenectady, N. Y.]
SODIUM CONTAMINATING IMPURITIES IN HELIUM. H. A. Fremont. June 1, 1949. Decl. Mar. 9, 1957. 15p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The following conclusions were reached from the considerations given: The important Na contaminating impurities in He are O, water vapor and hydrocarbons. The H and N content of the He used in a water moderated assembly (WMA) system should be limited to some moderate value. The present helium purity specifications for WMA are not realistic and should be revised. Bimonthly repurification of the sodium in the WMA reactor system should be considered. A proposed purity specification for the He to be used in the WMA reactor system is given, and

is considered to be very conservative. A number of advantages to relaxing the existing He specifications are listed. (auth)

3890 KAPL-M-HES-5
Knolls Atomic Power Lab., Schenectady, N. Y.
ACTIVATION OF STEAM BOILER WATER IMPURITIES–PROJECT SIR. H. E. Stone and D. G. Chappell. May 2, 1952. Decl. Mar. 14, 1957. 19p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The Submarine Intermediate Reactor steam drum is located outside the secondary shield. When the impurities in the boiler water exceed 1000 ppm the system will be blown down. Prior to blowdown, these impurities will circulate through the radiation zone where they will be activated by the neutron flux leaving the primary shield. The dose near the surface of the steam drum due to the above impurities has been calculated and resulted in 0.34 mr/hr. The total dose at this location must include the oxygen activity. This dose was 0.42 mr/hr. The total dose therefore will be 0.76 mr/hr which is just below the SIR specified level of 1 mr/hr for these activities. (auth)

3891 KAPL-M-JSK-3
Knolls Atomic Power Lab., Schenectady, N. Y.
CADMIUM AS A BURNABLE POISON LOCALIZED IN THE CENTRAL CORE REGION OF SIR. J. S. King. Aug. 12, 1954. Decl. Mar. 12, 1957. 11p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Certain reactivity control and self shielding data from a Submarine Intermediate Reactor experiment are briefly pointed out, which indicate that Cd loaded in the central core region is perhaps the best practical choice to meet the requirements of an ideal poison. The advantages of this choice are noted. Some curves are given as rough illustrations of the change in control cylinder characteristics as effected by B^{10}, Sm^{149}, and Cd^{113}. (M.H.R.)

3892 KAPL-M-LAB-1
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR DATA USED IN MULTIGROUP CALCULATIONS AT KAPL MARCH 1952 TO SEPTEMBER 1953. Laura A. Berger. Dec. 28, 1953. Decl. Mar. 12, 1957. 26p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70 (mf OTS).

These data include a table of densities, atomic weights, ξ's, and nuclei/cc; average cross sections; and the ratio of effective to atomic cross sections for several engineering designs. (M.H.R.)

3893 KAPL-M-SAR-RES-5
Knolls Atomic Power Lab., Schenectady, N. Y.
CONSEQUENCES OF LOSS OF FLOW. M. Altman. Mar. 16, 1955. Decl. Mar. 13, 1957. 30p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The consequences of a loss of power to the primary coolant pumps of the Submarine Advanced Reactor were evaluated. (T.R.H.)

3894 KAPL-M-SL-1
Knolls Atomic Power Lab., Schenectady, N. Y.
SHIELDING PROPERTIES OF A SIR MARK A CONTROL ROD DRIVE MECHANISM; SHIELDING LABORATORY EXPERIMENT NO. 1 (SL-1). L. H. Weinberg. Apr. 22, 1954. Decl. Mar. 11, 1957. 12p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

Shielding Laboratory Experiment SL-1 is described and the results are reported. In this experiment the neutron and gamma ray shielding properties of a control rod drive mechanism were determined. Measurements were made for fast neutrons, epithermal neutrons, thermal neutrons, and gamma rays. This information will be used in evaluating the shielding effectiveness of the mechanism. (auth)

3895 KAPL-M-SMS-47
Knolls Atomic Power Lab., Schenectady, N. Y.
POWER PLANT COOLANT TECHNOLOGY PROGRAM. S. L. Williams. Dec. 10, 1956. 57p. Contract W-31-109-eng-52. $10.80(ph OTS); $3.90(mf OTS).

The power plant coolant technology program is described. The technical activities involved are: the development of high temperature purification; corrosion product distribution measurements; corrosion product activity buildup and removal measurements; sampling system tests; high pH investigations; secondary purification, deaeration, and chemical treatment tests; coolant degasification and flux catalyzed reaction measurements; and fission product investigations. (M.H.R.)

3896 KAPL-M-WEC-8 and Add. 1 and Waiver 1
Knolls Atomic Power Lab., Schenectady, N. Y.
MODIFIED STRUCTURAL DESIGN BASIS, SAR REACTOR COMPONENTS. W. E. Cooper. Aug. 30, 1956. Includes Add. 1 and Waiver 1. 54p. Contract W-31-109-Eng-52.

This report contains a modified version of KAPL-M-WEC-7.

Stress, fatigue, and tolerance limits for Submarine Advanced Reactor components are given. (D.E.B.)

3897 KAPL-M-WJL-2
Knolls Atomic Power Lab., Schenectady, N. Y.
FAILURES IN THE S3G PRIMARY COOLANT SYSTEM; THEIR EFFECTS ON HULL INTEGRITY. W. J. Levedahl. Aug. 14, 1956. Decl. Feb. 21, 1957. 21p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A wide variety of accidents involving failure of the S3G primary coolant system have been analyzed, and the consequences to the power plant, hull integrity, and personnel both on and off hull, have been evaluated. In general, relative probabilities of various types of accidents decrease as the severity increases. It was found that failure of the pressure vessel, either from fatigue cracks at normal operating temperatures and pressures, or from a violent nuclear and/or chemical incident, can cause very high pressures in the shield tank followed by its rupture and possible formation of large, high-velocity missiles. Pressure against the bottom of the unreinforced hull is sufficient to cause its complete failure, even for comparatively mild accidents of non-nuclear origin, unless the hull is substantially reinforced. Reinforcement of the hull to a strength of about 2500 psi in the area below the shield tank will decrease the probability of endangering off-hull personnel by a large factor. (auth)

3898 LA-1155(Del.)
Los Alamos Scientific Lab., N. Mex.
ORALLOY SHAPE FACTOR MEASUREMENTS. V. Josephson, R. W. Paine, Jr., and L. L. Woodward. Aug. 8, 1950. Decl. with deletions Dec. 17, 1957. 35p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

Measurements were made at the Pajarito remote control laboratory to determine the effect of change of shape on system reactivity for oralloy cylinders. Systems tested include cylindrical configurations with various height-to-diameter ratios ranging from slabs to rods. Each system reactivity is referred to that of a sphere in the same tamper. Reactivity tests were made on bare (untamped) Oy configurations, as well as on systems in tuballoy tampers 1.12, 1.87, and 8.0 in. thick. The amount of reactivity change associated with a particular cylinder height-to-diameter ratio is found to be a function of tamper thickness, and is greatest for very thin tampers. (auth)

3899 NAA-SR-1109(Rev.)
North American Aviation, Inc., Downey, Calif.
SODIUM GRAPHITE REACTOR QUARTERLY PROGRESS REPORT [FOR] JULY–SEPTEMBER, 1954. Sidney

Siegel and Guy M. Inman, eds. Dec. 1, 1954. Decl. Mar. 4, 1957. 101p. Contract AT-11-1-GEN-8. $0.65(OTS).

Reactivity calculations have been performed for the steady-state Pu feedback technique outlined in the previous progress report. A full-scale power plant study was initiated, based on sodium-graphite technology. A twin-core power plant is now considered to be the most promising configuration. Several design drawings are given of such a reactor, using slightly enriched U to produce Pu and electrical power. The thermal neutron flux distribution in a cluster of 6 U rods was measured, and the results are compared with previous measurements for a 7 rod cluster. The average thermal cycling of hollow U slug elements was begun. Results are given for 500 cycles between 100 and 500°C. A series of powder-compacted U alloys were thermal cycled between 200 and 700°C. Data on the transfer of radioactivity from Zr by Na has been obtained from a capsule of the first series of three miniharps. Fe, Al, and Cu were immersed in toluene and irradiated at 150°F in the MTR-Gamma canal. Toluene is being considered as a shield coolant for the SRE. The effect of 1-Mev electron irradiation on terphenyls was also studied. A venting tube arrangement has been designed for the Zr-canned graphite moderator. A number of thermal insulating brick and fiber materials were subjected to liquid Na to study deterioration effects. The materials tested were Johns-Manville Brick C-16 (Sil-O-Cel mortar), Superex Paste, and Eagle-Pitcher Mineral Wool. Encouraging results were obtained in an effort to evaluate the effectiveness of Na decontamination by liquid ammonia. Pressure drop and flow characteristics of the latest design SRE fuel element have been completed. Design details of the 2-speed control rod drive assembly are given. Other aspects of the reactor control system, including design and component fabrication, are discussed. Gamma dose rates at the surface of the top shield were measured, together with the heat generation in the top thermal and biological shields. Revised plans for a fuel element and moderator-cell handling coffin, fuel storage system, and waste disposal system are outlined. (For preceding period see NAA-SR-1049.) (K.S.)

3900 NAA-SR-Memo-1542

[Atomics International Div.,] North American Aviation, Inc., Canoga Park, Calif.

MULTIGROUP CALCULATIONS OF SODIUM GRAPHITE REACTORS. Ira Bornstein. Jan. 20, 1956. 22p. $4.80 (ph OTS); $2.70(mf OTS).

Results of multigroup calculations of a sodium graphite reactor are presented. The criticality and spatial fission distribution of the reactor calculated for a three group model are compared with those calculated for a more elaborate eight group model. (auth)

3901 RDP-69

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE EFFECT OF STEEL RODS AND TRAY RODS ON THE NRU OUTPUT FRACTIONS AND REACTIVITY FOR THE PROPOSED CONTROL ROD SEQUENCE OF JULY 1956. R. M. Pearce and A. M. Williamson. Nov. 30, 1956. 8p.

3902 RDP-70

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NRU OUTPUT FRACTIONS AND REACTIVITY FOR 3½" CONTROL RODS IN THE SEQUENCE PROPOSED IN JULY 1956. R. M. Pearce and D. F. Saunders. Apr. 1, 1957. 9p.

3903 TID-5314(Del.)

[Knolls Atomic Power Lab., Schenectady, N. Y.].

MULTIGROUP INVESTIGATION OF LITHIUM COOLED BERYLLIUM MODERATED REACTORS. I. Bornstein. Jan. 2, 1953. Decl. Mar. 6, 1957. 10p. Contract W-31-109-Eng-52. $0.25(OTS).

A preliminary phase of the multigroup investigation of Li cooled, Be moderated reactors has been completed. The reactors investigated have "clean" cores—no Xe or other fission products and "clean" reflectors—no B. The Li was assumed to be pure Li^7. The critical characteristics of the reactors investigated are mapped. These mappings show the relationships between composition, power generated, and $v\Delta T$. The power generated was fixed at 125 megawatts and families of reactors requiring $v\Delta T$ of 2000, 4000, and 6000°F ft/sec are shown. (auth)

3904 TID-10028

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PRESSURIZED WATER REACTOR PROGRAM TECHNICAL PROGRESS REPORT FOR THE PERIOD OCTOBER 7, 1954 TO NOVEMBER 16, 1954. 89p. Contract AT-11-1-GEN-14. $0.50(OTS).

Functional requirements and system design parameters were established for a number of Pressurized Water Reactor components. No evidence of galvanic corrosion was found with the use of stainless and carbon steel in the steam generator design. Dimensions and design characteristics of a cylindrical annular seeded core with a natural UO_2 blanket were investigated. A fabricating process for U–Mo and UO_2 rods was investigated. The crystal structure of the U–Mo system was studied. Data are presented on the tensile properties of U–Mo alloys in the temperature range –85 to 700°F. Further studies are reported on the corrosion of Zircaloy-clad U–Mo alloys in high-temperature water, the effects of annealing on corrosion rate, and a measurement of the corrosion rate of U–Si alloys at 650°F. Corrosion testing of structural materials in boric acid and boric-acid ammonia systems was continued, together with the radiation testing of U–Mo alloys. Multigroup criticality studies and measurements for the seed core are reported. (C.H.)

3905 TID-10094(Del.)

American Machine and Foundry Co. Greenwich Engineering Labs., Greenwich, Conn.

STANDARDIZATION OF INDUSTRIAL NUCLEAR POWER PLANT COMPONENTS AND OF LOW POWER REACTOR SYSTEMS REPORT FOR 1954. Feb. 1955. Decl. with deletions Mar. 5, 1957. 204p. $1.10(OTS).

A study of nuclear power plant components and low power reactors has proven that, although standardization is now possible in the field of low power reactors, considerable work remains to be done to achieve component standardization. Certain fuel handling components and many control system components for large central station power reactors can be standardized, and designs of several components are shown. The consultation services furnished to laboratories and industrial groups are summarized. The results of low power reactor studies are reported. A "unitized" design concept for research reactors is presented. A short feasibility study of closed loop gas turbine cycles for small nuclear power plants is being completed. Studies of water cooled package power reactors has proven them to be feasible with a minimum of development. (M.P.G.)

3906 WAPD-26(Del.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

AN INTERPRETATION OF DATA ON ENRICHED HYDROGENOUS THERMAL REACTORS. Milton Danzker. Jan. 9, 1951. Decl. with deletions Mar. 4, 1957. 47p.

Contract AT-11-1-GEN-14. $7.80(ph OTS); $3.30(mf OTS).

In the case of the completely reflected reactor, the variational theory was extended to the case of a finite cylindrical reactor and successfully compared with the experimental data. The bare reactor was also examined, and an effective two-group age was estimated. The results indicate that the two-group constants, $L_1^2 = 8.3$ cm^2 and $L_f^2 = 33$ cm^2, are sufficient to explain the experimental results in a reactor which has an effectively infinite reflector. In general, it was not possible to compare the accuracy of two and four group calculations. The limitations are a ±5% experimental error and the difficulty of obtaining exact numerical results. (L.T.W.)

3907 WAPD-183

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EFFECTS OF IRRADIATION ON BULK UO_2. J. D. Eichenberg, P. W. Frank, T. J. Kisiel, B. Lustman, and K. H. Vogel. Oct. 1957. 192p. Contract AT-11-1-GEN-14. $5.00(OTS).

The irradiation experiments required to validate the use of bulk UO_2 as fuel in the Pressurized Water Reactor (PWR) are described. The performance of fuel elements consisting of bulk UO_2 fuel pellets encased in Zircaloy-2 tubing has been measured at burnup levels up to about 25,000 Mwd/T, both with undefected fuel elements and elements containing deliberately introduced defects, such defects permitting access of steam to the interior of the fuel elements. Finally, the behavior of assemblies of such elements in rigidly connected structures has been tested. The volatile noncondensable fission product gases, Xe and Kr, have been found to migrate in UO_2 by a diffusional mechanism. Their release to external surface is sensitive to diffusion path and interconnected porosity and, hence, to fuel material density. No appreciable structure changes, as revealed by x-ray diffraction, have been detected in U oxides of the fluorite structure at low burnup levels; the diffraction peaks of higher U oxides of orthorhombic structure were almost completely obliterated after the same low burnup. Likewise, no evidence has been noted of appreciable changes in density, metallographic structure, resistance to thermal fracture, or thermal conductivity in UO_2 at the highest burnups investigated. Thermal performance characteristics of Zircaloy-2 clad U oxide fuel elements were found, on the basis of observation of temperature induced structural changes, to be sensitive to initial assembly clearance between oxide and cladding and to the nature of the gas atmosphere within the tubing, whether helium or steam. The thermal performance could not be correlated with measured thermal properties of the oxide. Such fuel elements were found to be highly resistant to damage by power cycling or by "waterlogging" when fabricated of high density oxide. Suitably fabricated UO_2 pellets of high density were found to be highly resistant against erosion or release of solid oxide particles to the coolant. The release of fission products through defects in the cladding to a high temperature water system were best correlated by use of an "escape coefficient" defined as the fractional amount of each nuclide present within the fuel escaping per unit time. Most of those isotopes escaping from a defected rod through a recoil or diffusional mechanism are those which do not lead to excessive system contamination, whereas the "escape coefficients" of nuclides that adsorb strongly to container walls, and thus lead to high system contamination, are very low. Assemblies of fuel elements tested under conditions of marked asymmetry of neutron flux and, hence, of fuel element temperature, as well as under conditions simulating extreme fuel failures, revealed no tendency to structural warpage or progressive failure of fuel elements adjacent to those initially defected. (auth)

3908 WAPD-A1W(RD)-366(Rev.)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
STRESS ANALYSIS OF PLATE-TYPE FUEL SUBASSEMBLIES. B. R. Teer and D. E. Nestler. Dec. 1957. 26p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

An analytical investigation was made of some of the stresses in box-like subassemblies consisting of plate-type fuel elements and inactive end plates. The analysis is applicable to fuel plates having unequal clad and fuel alloy properties. (auth)

3909 WAPD-A1W(RDM)-320

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REQUEST FOR TECHNICAL DESIGN APPROVAL OF THE A1W CORE 1 SUPPORT PLATE WELDMENT AND THE A1W CORE 1 FORGED SUPPORT PLATE FOR THE PURPOSE OF OBTAINING MANUFACTURING RELEASE. G. W. Hardigg. Sept. 7, 1956. 9p. Contract AT-11-1-GEN-14.

With this are bound: Westinghouse Electric Corp. Physical Testing Lab. THE EFFECT OF REPEATED IMPACT ON THE DEFORMATION OF CRUCIFORM SECTIONS AT ROOM TEMPERATURE AND 600°F. A1W Test SP-1. Report No. E9800. G. Zibrotosky. May 14, 1956. 26p.; Westinghouse Electric Corp. Atomic Power Div. A1W SUPPORT PLATE WELDING FEASIBILITY AND DISTORTION. Test Specification SP-3. T-Spec. 554951. J. V. Marron and J. F. Gibbons. Sept. 5, 1956. 5p.; PHOTOELASTIC STUDY OF SUB-ASSEMBLY. Charles F. Peck, Jr., and Ralph G. Crum. Aug. 1956. 8p.; THERMAL STRESSES AND DISTORTIONS IN THE A1W CORE 1 SUPPORT PLATE. J. J. Lescisin. Aug. 1956. 6p.

3910 WAPD-P-386

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PEAK TO ASYMPTOTIC FLUX RATIOS FOR SLAB GEOMETRY. P. H. Wackman. Jan. 11, 1954. Changed from OFFICIAL USE ONLY Sept. 21, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

An approximate method is presented for estimating the magnitude of flux peaks in the water holes which remain after withdrawal of control rods. An infinite homogeneous reactor with a slot, of width 2a and filled with pure H_2O, cut through it, is assumed as a model. Differential equations are given for finding the fluxes. Peak to asymptotic flux ratios were computed as a function of gap width for various representative values. Data for H_2O were taken at 537°F. Results of computations are presented. (M.H.R.)

3911 WAPD-P-550

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
THE EFFECT OF CLADDING MATERIAL ON THE THERMAL NEUTRON FLUX SHAPE IN A UNIT CELL. W. R. Clancey. Oct. 1954. Changed from OFFICIAL USE ONLY Sept. 26, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

An expression is presented showing how the ratio of the flux at the outer edge of the clad to the flux at the inner edge of the clad depends on the scattering and absorbing properties of the clad, the clad thickness, and the ratios of the fuel region. The derivation presented of this expression is based on the diffusion theory equations as applied to a cylindrical fuel rod surrounded by an annular cladding which in turn is surrounded by an annulus of

moderator material. Some numerical data are presented based on the derived expression showing the effect of Al and Zr cladding on the thermal neutron flux in some typical cells. (M.H.R.)

3912 WAPD-PWR-FE-1147
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE WAPD 15-1 AND 15-2 PROGRESSIVE FAILURE TESTS IN THE MTR-HT-1 LOOP. T. J. Kisiel. Mar. 22, 1956. Decl. Mar. 18, 1957. 28p. $4.80(ph OTS); $2.70 (mf OTS).

Two PWR-type (Shippingport Pressurized Water Reactor) fuel rod bundles, each containing one intentionally defected rod, were tested in a Materials Testing Reactor loop to study the possibility of progressive failure. Progressive failure is the phenomena in which an initial element failure causes failure in its neighboring elements as a result of heat concentration induced by intimate contact between heat transfer surfaces and loss of coolant flow from channel blocking. The 15-1 bundle, containing a bent rod contacting two adjacent rods, was tested at a level equivalent to 40% of PWR peak heat flux and showed no indication of progressive failure. The 15-2 bundle, containing a bent, water-logged rod with its cladding notched at the two points of contact with adjacent rods, was tested at a level equivalent to PWR heat flux. The 15-2 defective rod split open in one of the notches in the early stages of the test, but this produced no failure in neighboring rods. Post-test examination of the bundles showed that the defected rods were no longer in contact with their adjacent rods, probably as a result of general fuel rod growth and stress relief of the bent rods. Examination of the 15-2 defective rod indicates that the desired "worst case," in which the exposed fuel of the initial failure makes intimate contact with the cladding of a neighboring rod, was not obtained. It is possible that such a condition can be achieved by faster reactor start-up rates and more drastically defected rods. (auth)

3913 WAPD-PWR-Ph-66
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
FISSION PRODUCT ACTIVITIES FROM CORE CORROSION. PART I. A DESCRIPTION OF THE CODE HYDRA FOR SIMPLE DECAY. B. D. O'Reilly. Jan. 1956. 33p. $6.30(ph OTS); $3.00(mf OTS).

An attempt is made to give a phenomenological description to the transport of corroded core materials around the primary water system, and, hence, to describe the build-up of radioactivity associated with the transported isotopes. The development of the problem as given is used as the basis for a code for the NORC, a floating decimal point digital computing machine. The methods whereby this problem is adapted to machine computation are discussed along with the mathematical formulation. Only the build-up of those isotopes which are produced directly in fission will be considered. The production of transuranic isotopes is not treated. (M.H.R.)

3914 WAPD-Re-V(E)-53
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CONTROL ROD DRIVE MECHANISM—LINE 6 (a)—EVALUATION OF LINEAR MOTOR. W. E. McCown. Aug. 21, 1952. Decl. May 3, 1957. 8p. $1.80(ph OTS); $1.80(mf OTS).

The ability of the linear motor to drive the regulating rod in such a manner as to provide stable control of the reactor during all phases of operation is evaluated. Operation of the reactor with a fixed or manually operated 19th shim rod in place of the regulating rod, and utilizing only the temperature coefficient and relay-type positioning of the outer rods to control reactivity, is discussed. The results of performance tests on the linear motor are presented. (M.H.R.)

3915 Y-1023
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
MINIMUM CRITICAL MASS AND UNIFORM THERMAL NEUTRON CORE FLUX IN AN EXPERIMENTAL REACTOR. J. W. Morfitt. Dec. 1, 1953. Decl. Sept. 12, 1957. 167p. Contract W-7405-eng-26. $4.50(OTS).

The relationship between minimum critical mass and uniform thermal neutron core flux was experimentally investigated in a water-moderated water-reflected nuclear reactor employing U^{235} as fuel. The reactor vessel was a right circular cylinder of Al, 72 cm in diameter and 91.4 cm long. The core, 30.2 cm in diameter, was divided into 5 concentric regions by Al partitions and was surrounded by an effectively infinite water reflector on its lateral surface only. Varying concentrations of aqueous uranyl fluoride solution made from U containing 93.2% of the U^{235} isotope were added to the several regions to simulate a theoretical fuel distribution having a continuous concentration gradient. The theoretical fuel distribution was that given by a calculation method developed in a theoretical treatment of the problem by Goertzel, who demonstrated mathematically that the condition of minimum critical mass in a suitably chosen thermal reactor required that the thermal neutron flux be uniform everywhere in the core. The experimental results clearly establish the validity of the Goertzel theory. The experimentally determined critical height and mass, using the theoretically determined fuel loading, were within 2.5% of the corresponding calculated parameters. The importance function for the fuel was shown to be constant throughout the core as required for a minimum critical mass reactor. The measured thermal and non-thermal components of the neutron flux were in good agreement with theory, and the thermal flux, except for deviations produced by the stepwise approximation to the ideal fuel distribution, was uniform along a radius of the core. The longitudinal neutron flux behaved as expected; a measure of the Cd fraction showed the reactor to be essentially thermal, and in general, data obtained from the experimental reactor were compatible with the postulates and predictions of the Goertzel theory. An exploratory investigation to obtain experimental verification of a modification of the theory made by Goertzel to predict how the critical mass of fuel can be minimized in a reactor of less than optimum radius met with little success. Although some lowering of the critical mass was produced by the theoretically determined fuel distribution, a discrepancy of more than 35% was found to exist between theory and experiment. (auth)

3916 Y-B32-103
Oak Ridge National Lab., [Y-12 Area], Tenn.
POSSIBLE COOLANTS FOR SOLID FUEL REACTORS. W. R. Grimes. Nov. 25, 1952. Decl. July 5, 1957. 4p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

3917 Y-F8-20
Oak Ridge National Lab., Y-12 Area, Tenn.
TEMPERATURE DROPS IN ARE REFLECTOR AND PRESSURE SHELL DUE TO γ-HEATING. S. V. Manson. Apr. 3, 1951. Decl. July 5, 1957. 7p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

On the basis of heat generations most recently estimated by M. C. Edlund, the calculated maximum temperature drops are: in a pressure-shell dome two inches thick, 9.5°F, in a (shell + flange) thickness of four in., 26°F, and in the reflector, 54°F. The total heat generated in the shell

was roughly estimated to be 44 kw, about 1.5% of the currently envisaged ARE power level. (auth)

3918 Y-F10-48(Del.)
Oak Ridge National Lab., Y-12 Area, Tenn.
SPHERICAL REACTOR WITH ABSORBING INTERFACE. R. R. Coveyou. Apr. 13, 1951. Decl. with deletions Feb. 21, 1957. 8p. Contract W-7405-eng-26. $1.80(ph OTS); $1.80(mf OTS).

A spherical reactor is considered with an absorbing layer between core and reflector. Diffusion equations for the reactor are solved. (L.T.W.)

3919
SHOULD AMERICAN REACTOR DEFINITIONS REMAIN UNTRANSLATED? K. H. Hoecker. Atomwirtsch. 2, 373-5(1957) Nov. (In German)

German technical terms used in reactor engineering are far from well defined. They are generally based on expressions previously coined in English speaking countries. Some of these have been accepted as they stand while in other cases various scientists or groups have coined different, synonymous German words. The situation must be changed now, because the use of certain technical terms is beginning to spread to wider circles. English words should however not be germanized at all cost, but being foreign words they ought to be modified in such a way that they will be grammatically acceptable. The author discusses a number of examples on hand of a list and compares about 100 English terms with some corresponding German suggestions. The list ought to be specially useful to the foreigner. (tr-auth)

3920
GRADUAL EVOLUTION OF THE MULTIPLICATION FACTOR OF ZOÉ. D. Breton and R. Vidal. Bull. inform. sci. et tech. No. 1, 4-7(1957). (In French)

The gradual decrease in the multiplication factor of Zoé Reactor at Chatillon, France, is due to fission product poisoning. Plutonium formation, very slight in Zoé, contributes practically nothing to increasing the reactivity. The purpose of this study is to evaluate the decline of reactivity as a function of time and to compare the calculated values with those measured the last few years. The roles of Sm^{149}, the biggest contributor to the poisoning, Sm^{151}, and other fission products were investigated, and the contribution of Pu^{239} formation was evaluated. (T.R.H.)

3921
THE EXPERIMENTAL NUCLEAR REACTOR "AQUILON." Y. Girard, J.-C. Koechlin, and J.-M. Moreau. Industries Atomiques No. 9-10, 47-56(1957). (In French)

Reactors in general are discussed preliminary to the description of the Aquilon experimental reactor. Aquilon is a research reactor designed to operate intermittently at low power levels. The usual power level is one watt, the maximum, 100 watts with a neutron flux at the center of 10^9 n/cm^2/sec. It operates at ordinary temperatures, presenting no cooling problem and the shielding requirements are very simple. It is fuelled with natural U, moderated by heavy water and has a graphite reflector. Control, safety, experimental facilities and nuclear characteristics are also described. (T.R.H.)

3922
PURIFICATION OF THE WATER OF THE NEUTRON CONVERTER POOL AT CHATILLON. Alphonse Fischmann. Industries Atomiques No. 9-10, 83-7(1957). (In French)

The water purification system which maintains the resistance of the water in the experimental pool adjacent to the Zoe Reactor at 4 to 5 × 10^6 ohms is described. The pool volume is about 24 m^3 and is automatically recycled through ion exchangers when the resistivity drops. (T.R.H.)

3923
POWER FROM ATOMIC REACTORS. George A. Papadatou (Greek Committee of Atomic Energy, Athens, Greece). The Technical Chronicles Nos. 391-392, 27p. (1957). (In Greek)

A general review is presented on atomic energy and on the utilization of fission chain reactions as a new source of energy. Classifications of atomic power reactors, types of reactors, construction materials, core specifications, enrichment, cooling devices, fuel, moderators, shielding, etc. are discussed and economic aspects of reactor power production are analyzed. (R.V.J.)

Nuclear Transformation

3924 UCRL-4969
California. Univ., Livermore. Radiation Lab.
RADIATIVE CAPTURE OF PROTONS IN Ne^{20}. R. E. Pixley, R. E. Hester, and W. A. S. Lamb. Oct. 16, 1957. 10p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80 (mf OTS).

A preliminary measurement of the $Ne^{20}(p,\gamma)Na^{21}$ reaction cross section has been made. Targets were prepared by bombarding aluminum targets with neon ions. The neon concentration in the target was determined by elastic scattering of 1.5-Mev protons. The yield of positrons from the reaction $Ne^{20}(p,\gamma)Na^{21}(\beta)Ne^{21}$ was identified by the 23-second half life of Na^{21}. The reaction cross section was found to be $(2.4 \pm 1.0) \times 10^{-3}$ barns at 390 kev. (auth)

3925
ANGULAR AND ENERGY DISTRIBUTION OF PROTONS FROM THE PROCESS $A^{40}(\gamma,p)Cl^{39}$. F. Gudden and J. Eichler. Naturwissenschaften 44, 508-9(1957). (In German)

3926
NUCLEAR INTERACTIONS WITH 220-Mev DEUTERONS. L. P. Solov'eva. Soviet Phys. JETP 4, 923-5(1957) July.

Results of investigations of the interaction between fast deuterons and the elements contained in nuclear emulsions are presented. (A.C.)

3927
INVESTIGATION OF THE (γ,p) REACTION IN ZINC. R. M. Osokina and B. S. Ratner (Academy of Sciences, USSR). Soviet Phys. JETP 5, 1-7(1957) Aug.

Measurements of the yield and angular and energy distribution of photoprotons emitted from zinc have been carried out at various bremsstrahlung peak energies ranging from 19.8 to 30.7 Mev. The results are compared with the statistical theory of nuclear reactions and with the direct photoeffect model. The data obtained with zinc confirm the conclusions regarding the significance of a direct photoeffect and of the influence of shells for nuclei with Z ~ 30. (auth)

3928
DISINTEGRATION OF SILVER AND BROMINE NUCLEI BY HIGH ENERGY PROTONS. V. I. Ostroumov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 12-20(1957) Aug.

The interaction with heavy nuclei in emulsion of protons with energies 130, 460, and 660 Mev was studied. By observing the tracks of recoil nuclei in stars formed as a result of this interaction, the average number of cascade protons and alpha-particles in stars with different numbers of prongs was determined. The relation between the number of "black" prongs and the mean excitation energy of the nucleus was established for all three energies of the bombarding protons. The distribution of nuclei according to excitation energy was found. The experimentally observed energy spectrum of the protons differs somewhat from an evaporation spectrum. (auth)

3929
ANGLE-ENERGY DISTRIBUTION OF PHOTONEUTRONS FROM Bi. G. N. Zatsepina, L. E. Lazareva, and A. N. Pospelov (Academy of Sciences, USSR). Soviet Phys. JETP 5, 21-3(1957) Aug.

The angle-energy distribution of photoneutrons emitted from bismuth bombarded by x rays with a maximum energy E_{max} = 18.9 Mev has been investigated using nuclear emulsions. The energy distribution obtained includes a large number of energetic neutrons which cannot be explained in terms of the statistical theory. (auth)

3930
ANGULAR DISTRIBUTION OF THE PRODUCTS OF THE $S^{32}(d,p)S^{33}$ REACTION. I. B. Teplov, B. A. Iur'ev, and T. N. Markelova (Moscow State Univ.). Soviet Phys. JETP 5, 134-6(1957) Aug.

The angular distribution of protons produced in the $S^{32}(d,p)S^{33}$ reaction for 1.8 and 3.8 Mev deuterons was measured. (L.T.W.)

3931
INVESTIGATION OF THE EXCITATION FUNCTIONS FOR THE REACTIONS $C^{12}(p,pn)C^{11}$, $Al^{27}(p,3pn)Na^{24}$ AND $Al^{27}(p,3p,3n)Na^{22}$ IN THE 150-660 Mev ENERGY RANGE. Iu. D. Prokoshkin and A. A. Tiapkin (United Inst. of Nuclear Studies). Soviet Phys. JETP 5, 148-9(1957) Aug.

3932
ON THE THEORY OF STRIPPING AT HIGH ENERGIES. A. I. Akhiezer and A. G. Sitenko (Khar'kov State Univ. Physico-Technical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1040-2(1957) Oct. (In Russian)

Attempts are made to determine the cross section of the stripping reaction without the assumption that the nuclear radius is greatly larger than the deuteron radius. The reaction in which neutrons are liberated and protons are absorbed by nuclei was selected for investigation. (R.V.J.)

Particle Accelerators

3933 CERN-57-45
European Organization for Nuclear Research, Geneva.
CALCUL D'ORBITES DANS UN SYNCHRO-CYCLOTRON D'APRÈS LES DONNEES TECHNIQUES EN CONSIDÉRANT LA CHARGE D'ESPACE—L'ANALOGIE AVEC L'OSCILLATEUR ANHARMONIQUE. (Calculation of Orbits in a Synchro-Cyclotron According to Techniques Given in Consideration of the Space Charge—Analogy with the Anharmonic Oscillator.) R. Keller, M. Fidecaro, and M. Barbier. Oct. 15, 1957. 45p.

3934 ORNL-2403
Oak Ridge National Lab., Tenn.
A SQUARE-WAVE CYCLOTRON OSCILLATOR. C. D. Goodman. Jan. 10, 1958. 58p. Contract W-7405-eng-26. $1.75(OTS).

It is shown that replacing the usual sine wave accelerating voltage in conventional cyclotrons with a square wave would result in less beam loss due to electric defocusing; in AVF cyclotrons it would result in greater tolerances on the average field accuracy and possibly in better beam quality. A brief analysis of the problem of generating periodic voltages other than simple sine waves in high-Q systems is given. Two systems capable of generating an approximate square wave by adding first and third harmonic frequencies are discussed, and tables of parameters for these systems are given. Wave forms obtained with one of the systems are shown. (auth)

3935 TID-7545
Division of Research, AEC and New York Operations Office. Health and Safety Lab., AEC.
CONFERENCE ON SHIELDING OF HIGH-ENERGY ACCELERATORS HELD AT NEW YORK, APRIL 11 to 13, 1957. 231p. $2.75(OTS).

Papers are included on the shielding facilities of the Univ. of Calif. Radiation Lab. Synchrocyclotron, Carnegie Inst. of Tech. Synchrocyclotron, Univ. of Chicago Synchrocyclotron, Columbia Univ. Synchrocyclotron, Harvard Univ. Synchrocyclotron, Univ. of Rochester Synchrocyclotron, Brookhaven National Lab. Proton Synchrotron, Univ. of Calif. Radiation Lab. Proton Synchrotron, Calif. Inst. of Tech. Electron Synchrotron, Mass. Inst. of Tech. Electron Synchrotron, National Bureau of Standards Electron Synchrotron, Purdue Univ. Electron Synchrotron, Cornell Univ. Electron Synchrotron, and Stanford Univ. Linear Accelerator. Other papers were given on factors influencing shield design and accelerator location, composition, properties, and cost of high-density concretes, legal radiation-safety responsibilities of accelerator projects, Monte Carlo calculations on the high-energy radiation component in the shield, attenuation, build-up factors, skyshine, calculational methods for reactor shielding, data required for shielding experiments with high-energy particles, effect of ionizing radiation on mammals and its implications for accelerator shielding, radiation induced cataracts, maximum permissible radiation levels, and future trends in maximum permissible radiation levels. Shielding designs presented for accelerators now under construction are Argonne National Lab. 12.5 Bev Electron Accelerator, Princeton-Penna. 3-Bev High-Intensity Proton Synchrotron, Brookhaven National Lab. 30-Bev Proton AGS, new Cosmotron shielding, shielding work at Stanford Univ., and Brookhaven National Lab. AGS. (M.H.R.)

3936 UCRL-8010
California. Univ., Berkeley. Radiation Lab.
BEVATRON INDUCTION-ELECTRODE BEAM-MONITORING SYSTEMS. J. T. Lavrischeff. Oct. 3, 1957. 17p. Contract W-7405-eng-48. $0.75(OTS).

A system is described that uses the east induction electrode in the Bevatron to provide beam-amplitude signals for specialized monitoring and for primary calibration of other beam-monitoring equipment. A system is also described that uses the south induction electrodes to provide beam-position signals for tracking, and beam-amplitude signals for intensity control and general distribution to experimenters associated with the Bevatron and (by means of the telemetering radio link) to those in other areas. A brief description is given, for each system, of induction-electrode signals, signal-amplifying, -detecting, and -isolating equipment, calibration equipment, signal distribution, control features, a meter circuit reading directly in protons per pulse, and various recording facilities. The systems described are stable and self-calibrating, and are intended to provide the facilities indicated with a minimum of maintenance and operational difficulty. (auth)

3937
BEAM STACKING EXPERIMENTS IN AN ELECTRON MODEL FFAG ACCELERATOR. K. M. Terwilliger, L. W. Jones, and C. H. Pruett (Midwestern Universities Research Assoc., Madison, Wisc.). Rev. Sci. Instr. 28, 987-97(1957) Dec.

A number of experiments are described which test the interactions of particles with r-f accelerating voltages in an FFAG accelerator. The experiments confirm predictions of a theory of Symon and Sessler and demonstrate the feasibility of "stacking" successively accelerated groups of particles with a density close to that of a single group. (auth)

3938

COOLING SYSTEM FOR GAS TARGET ENTRANCE WINDOWS. Mary Jean Scott and Robert Lindgren (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 28, 1090-1 (1957) Dec.

One of the most stringent intensity limitations on medium energy accelerator experiments using foil-contained gas target chambers has been the apparent impossibility of putting large currents through the entrance foil without melting it. It has been found, however, that if a 0.05-mil nickel foil is suitably cooled by a jet of cold gas, currents as high as 20 μa of 2-Mev protons may be used. The cooling jet is made from a piece of one-eighth-in.-diam. copper tubing modified to yield a jet of gas for cross section one quarter inch by twenty mils. The target gas is used as the cooling gas. The helium gas used flows from a tank through copper tubing immersed in liquid nitrogen, into the target chamber, and then out through a vacuum pump. (A.C.)

3939

THE METHOD OF ENVELOPES FOR INVESTIGATING FREE OSCILLATIONS IN ACCELERATORS. A. M. Baldin, V. V. Mikhailov, and M. S. Rabinovich (Academy of Sciences, USSR). Soviet Phys. JETP 4, 857-64(1957) July.

A derivation is given of the equation for free oscillations in accelerators with an arbitrary magnetic field having a plane of symmetry. To solve the basic problems of the theory of free oscillations, which arise in the design of accelerators, an envelope method has been developed in which the study of individual orbits is replaced by consideration of the envelope of the trajectory of the particles over a large number of revolutions. The application of the method is illustrated for accelerators with a sector magnet and for strong-focusing accelerators. (auth)

3940

EXCITATION OF BETATRON OSCILLATIONS BY SYNCHROTRON MOMENTUM OSCILLATIONS IN A STRONG FOCUSING ACCELERATOR. M. F. Orlov. Soviet Phys. JETP 5, 45-8(1957) Aug.

The occurrence of resonances between the synchrotron oscillations of the momentum p and the amplitude beats near resonance on magnetic field perturbations is demonstrated. Resonances occur if the ratio between the beat frequency (for $\Delta p/p = 0$) and the frequency of synchrotron oscillations is an integer. Transitions through these resonances are examined in the linear and nonlinear approximations. (auth)

3941

A NONLINEAR THEORY OF PHASE OSCILLATIONS OF ELECTRONS INDUCED BY QUANTUM RADIATION FLUCTUATIONS IN SYNCHROTRONS. A. N. Matveev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 913-17(1957) Oct. (In Russian)

A nonlinear theory of phase oscillations induced by radiation fluctuations in electron synchrotrons is considered. It is shown that the nonlinear theory essentially corrects results of a linear theory. The nonlinear theory predicts more significant electron losses and imposes upon synchrotron parameters stronger restrictions than a linear theory. (tr-auth)

3942

COMPARISON OF CALORIMETRIC AND IONIZATION MEASUREMENTS OF γ-RADIATION ENERGY FLUX FROM A SYNCHROTRON. S. P. Kruglov (Leningrad Inst. of Physics in Technology). Zhur. Eksptl'. i Teoret. Fiz. 33, 1060-2(1957) Oct. (In Russian)

Radiation Absorption and Scattering

3943 NYO-2165

Columbia Univ., New York and Francis Delafield Hospital. Physics Lab., New York.

ATTENUATION OF SCATTERED COBALT 60 RADIATION IN LEAD AND BUILDING MATERIALS. R. T. Mooney and C. B. Braestrup. Oct. 29, 1957. 24p. Contract AT(30-1)-1751. $0.75(OTS).

3944 USNRDL-TR-174

Naval Radiological Defense Lab., San Francisco.

GAMMA-RAY COLLIMATOR PENETRATION AND SCATTERING EFFECTS. R. L. Mather. May 20, 1957. 38p. Project NS 081-001.

Expressions are developed which give the amount of unidirectional radiation from a distant radiation source passing through a cylindrical hole in a slab of material, including the amount of radiation which penetrates the edges of the hole, as a function of angle between the radiation direction and the axis of the hole. The modifications necessary for sources at finite distances are indicated. These functions are integrated over appropriate angles for distant line sources and for extended sources. It is shown that, to a first approximation, the results are the same as the geometrical aperture for a like diameter hole in a similar slab with one mean free path of material removed from each side. The effects due to scattering from the walls of the collimator are discussed and an approximate method of calculation is presented with results for a specific collimator. (auth)

3945

FURTHER APPROXIMATE STUDIES ON BETA RAY ABSORPTION AND TRANSMISSION. Erik Odeblad. Acta Radiol. 48, 289-306(1957) Oct.

Approximate and simplified theoretical considerations result in the binominal formula proposed earlier for describing transmission of beta rays. Experimental measurements on 18 radionuclides are presented and support the preference for the binominal formula rather than the exponential formula. The dependence of the exponent in the binominal formula on maximum beta energy, nuclear Coulomb effects, forbiddeness and geometry factors during measurements have been studied. (auth)

3946

DIFFUSION OF CHARGED PARTICLES IN A HOMOGENEOUS ELECTROMAGNETIC FIELD. Khr. Ya. Khristov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 116, 213-16(1957) Sept. 11. (In Russian)

3947

CALCULATION OF ENERGY DISSIPATION BY GAMMA RADIATION NEAR THE INTERFACE BETWEEN TWO MEDIA. Martin J. Berger (National Bureau of Standards, Washington). J. Appl. Phys. 28, 1502-8(1957) Dec.

A Monte Carlo calculation was made of the energy dissipation by gamma radiation in a medium with the scattering properties of water which consists of two semi-infinite regions, one of which is much denser than the other. The calculations are for a 1.28-Mev point-isotropic source at or near the boundary plane separating the two regions. The results are presented in terms of boundary correction factors which express the change of energy dissipation compared to that prevailing at the same location in a medium of uniform density. The analysis of the results leads to the conclusion that the boundary effect is rather insensitive to the atomic number of the medium, and is mainly a function of the density change. The Monte Carlo results are in good agreement with an experiment of Soole

on the propagation of radiation in the air above the ground, and an experiment by Titus on the dose distribution in iron. (auth)

3948

ON MULTIPLE SCATTERING MEASUREMENTS IN NUCLEAR EMULSIONS. M. di Corato, B. Locatelli, and D. Hirschberg. Nuovo cimento (10) 4, Suppl. No. 2, 448-53(1956).

Results are reported of scattering measurements made at the laboratories of Brussels and Milan on « flat » tracks — both of particles at the end of their range, by the constant sagitta method and of fast particles — in order to obtain an experimental calibration of the ratio of the sagittae estimated by the method of second and third differences and of the errors of these estimates. The experimental material consisted of 46 π-meson and 30 proton tracks stopping in the emulsion, and of 34 fast tracks. In addition, the fourth differences were calculated on part of the stopping particles. (auth)

3949

SCATTERING OF POLARIZED POSITRONS BY POLARIZED ELECTRONS. J. M. C. Scott (Cavendish Lab., Cambridge). Phil. Mag. (8) 2, 1472-4(1957) Dec.

The cross sections for the scattering of polarized positrons and electrons by polarized electrons have been calculated. (auth)

3950

THE PHOTON-NUCLEON SCATTERING. Shigeo Minami and Yoshio Yamaguchi (Osaka City Univ.). Progr. Theoret. Phys. (Japan) 17, 651-8(1957) May.

The general expressions, the differential cross section, and the polarization of the recoil nucleon of the photon-nucleon scattering are given. Then experimental data of the photon-nucleon scattering at high energies are analyzed in terms of the shadow scattering of the photonpion production. (auth)

3951

TOTAL INELASTIC INTERACTION CROSS SECTIONS OF 225 ± 10 Mev NEGATIVE π-MESONS WITH C, Al, Cu, Sn, AND Pb NUCLEI. V. G. Ivanov, V. T. Osipenkov, N. I. Petrov, and V. A. Rusakov. Soviet Phys. JETP 4, 922-3 (1957) July.

Experiments were carried out with the synchrocyclotron of the Laboratory of Nuclear Problems to determine total cross sections for the inelastic interaction of π mesons with nuclei of carbon, aluminum, copper, tin, and lead. The method employed was the recording of events which result in the removal of a particle from the beam in passing through a scatterer made of the substance under investigation. (A.C.)

3952

ELASTIC SMALL ANGLE SCATTERING OF NEUTRONS BY HEAVY NUCLEI. V. S. Barashenkov, I. P. Stakhanov, and Iu. A. Aleksandrov. Soviet Phys. JETP 5, 144-7 (1957) Aug.

3953

ABSORPTION OF γ-QUANTA OF 500 Mev MEAN ENERGY IN LEAD, COPPER AND ALUMINUM. M. D. Baiukov, M. Ts. Organesian, and A. A. Tiapkin (United Inst. of Nuclear Studies). Soviet Phys. JETP 5, 151-2(1957) Aug.

3954

POLARIZATION IN THE ELASTIC SCATTERING OF NUCLEONS ON A TARGET WITH SPIN ONE. G. M. Budyanskii (Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 889-900(1957) Oct. (In Russian)

A determination is made of the mean values of the spin operators of a system of particles of spin 1 and ½. The most general expression is found and an explicit form of the transition matrix is given. A particular case is considered of small energies at which it is possible to confine oneself to S and P waves. Equations are obtained for cross section, polarization, and correlation functions. Relationships are established between the parameters of the transition matrix and the experimentally observed values. A set of experiments is indicated which enables carrying out triple scattering, to determine the amplitude of the scattered wave, and to make a phase analysis. (tr-auth)

3955

SCATTERING OF SLOW NEUTRONS IN FERROMAGNETICS. S. V. Maleev (Physico-Tech. Inst. of Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 33, 1010-21(1957) Oct. (In Russian)

The scattering of slow neutrons in single crystal and polycrystal ferromagnetics was considered using the theory of spin waves. (tr-auth)

3956

POLARIZATION OF PROTONS IN QUASI-ELASTIC p-p SCATTERING ON DEUTERONS AT 635 MEV. Yu. P. Kumekin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 1056-7(1957) Oct. (In Russian)

3957

ON THE DIFFRACTION SCATTERING OF HIGH ENERGY PROTONS ON PROTONS. V. G. Grishin and I. S. Saitov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 33, 1057-63(1957) Oct. (In Russian)

Collisions of high energy protons without any specific relation to any model were analyzed with the assumption that the spin dependence of nuclear forces can be neglected, and that the imaginary part of the scattering amplitude is considerably larger than the factual one. The angular distributions of p-p scattering at 8 to 10 Bev were calculated by the linear extrapolation of the cross section of inelastic processes and the parameter in the energies up to 10 Bev. Results point to almost linear increase of R with the energy beginning at 2.27 Bev. Analysis of the previous data showed that the assumptions offered by S. Z. Belenkii JETP 30, 983, 1956 for the diffraction scattering of high energy π mesons on nucleons hold for p-p scattering with $E_p \geq 1.5$ Bev. (R.V.J.)

3958

ON CORRECTIONS OF APPROXIMATION FOR SMALL ANGLES IN MULTIPLE SCATTERING PROBLEMS. T. A. Germogenova (Mathematical Inst. Acad. of Sciences). Zhur. Eksptl'. i Teoret. F 33, 1067-9(1957) Oct. (In Russian)

Radiation Effects

3959 AERE-C/M-207

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF RADIATION ON THE ELECTRICAL PROPERTIES OF ANION EXCHANGE MEMBRANES. G. C. Barker and A. W. Gardner. Sept. 7, 1954. Decl. July 8, 1957. 8p.

The useful life of an anion exchange membrane when used for the deacidification of radioactive solutions of high specific activity may be shortened by the radiation which the membrane receives from the solution in its neighborhood. Exposure to fast electrons from β emitters, or produced by the absorption of γ radiation, leads to a gradual loss of exchange capacity which is accompanied by a rise in membrane resistance and some deterioration in the mechanical properties of the membrane. To form an approximate estimate of the life of a membrane under such conditions a crude study has been made of the effect

of β and γ radiations on the electrical properties of Permaplex A 10 membranes. Time has not permitted a systematic approach to this problem and the tentative conclusions given are based on the results of a small number of experiments. (auth)

3960 NARF-57-19T(Vol. 2)
Convair, Fort Worth, Tex.
FIRST SEMIANNUAL 125A RADIATION EFFECTS SYMPOSIUM, MAY 22-23, 1957. 140p. (FZK-9-118 (Vol. 2)).

Papers are included on the effect of radiation on diode characteristics, some observations of the effect of radiation on the refractive indices of certain gases, electromagnetic noise propagation observation in the vicinity of a nuclear reactor, γ spectra measurements of the neutron-induced activity of two jet engines, design of radiation effects testing reactors, design of radiation effects experiments, the rate of production of interstitial vacancy pairs for several neutron flux spectra, Monte Carlo analysis of the annealing of Frenkel defects, radiation effects analysis methods for nuclear aircraft design, and neutron activation of aviator's breathing oxygen. (M.H.R.)

3961 NARF-57-50T
Convair, Fort Worth, Tex.
REVISED ACTIVATION HANDBOOK FOR AIRCRAFT DESIGNERS. Sept. 30, 1957. 406p. (FZK-9-124).

This handbook contains a compilation of essential information on activation phenomena and the means of extending these expressions to particular cases of interest to nuclear aircraft design engineers. Thermal neutron gamma activation tables are included for a number of aircraft alloys for various irradiation and decay times. Necessary information is included for the calculation of activation γ dose rates from the individual radioisotopes of a number of materials. Theories are reviewed which form the basis for the fundamental equations, and calculation methods are described. (See also NARF-55-55T, Vol. I and Vol. II.) (C.H.)

3962 NYO-7299
Rutgers Univ., New Brunswick, N. J. Coll. of Engineering.
X-RAY INVESTIGATION OF NEUTRON-IRRADIATED METAL WIRES AND UNIRRADIATED GERMANIUM SINGLE CRYSTALS. Technical Report No. 2. J. J. Slade, Jr., E. Sturm, L. F. Nanni, and S. Weissmann. Oct. 15, 1957. 24p. Contract AT(30-1)-1730. $4.80 (ph OTS); $2.70(mf OTS).

X-ray double-crystal diffractometer studies of neutron-irradiated copper, molybdenum, and platinum wires have been carried out. Only the platinum wire, after irradiation, exhibited an increase in the angular range of grain reflections, changes in the distribution of intensities of reflection curves and the disappearance of the diffused matrix background. X-ray studies of single germanium crystals disclosed that the rocking curve width is dependent on the size of the irradiated area but independent of the crystallographic direction in the (hkl) planes investigated. A detailed experimental and theoretical treatment of the influence of the surface characteristics on the shape of the rocking curve is presented. A mathematical expression was derived which relates small variations in the width of the rocking curve to variations in the distribution of crystal imperfections. (auth)

3963 WAPD-S5W-EP-23
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
INSULATION RESISTANCE OF THERMOELECTRIC MAGNESIA INSULATED CHROMEL–ALUMEL THERMOCOUPLES. [Experiment] WAPD-1-6. F. Gaidos and H. L. Glick. [1954?]. 13p. $3.30(ph OTS); $2.40(mf OTS).

The thermocouple consists of a stainless steel jacket, nominally $\frac{1}{16}$ in. OD, housing Size 30 B and S gage chromel and alumel wires insulated with magnesium oxide. The functional properties of the thermocouple in high temperature and high neutron density environments were measured. (L.T.W.)

3964 WADC-TN-57-185
Inland Testing Labs., Morton Grove, Ill.
DETERMINATION OF TESTING SCHEMES FOR ANP WEAPON SYSTEM MATERIEL. M. E. Krasnow, O. P. Reynolds, R. L. Thistlethwaite, E. J. Viltar, H. G. R. White, and H. A. Mitchell. May 30, 1957. 114p. Project No. 7112. Contract AF33(616)-3912. (AD-118288).

In order to build a nuclear powered vehicle, it is necessary to build systems that will operate satisfactorily in conjunction with a nuclear environment. Before design and development testing can begin, it is necessary to determine which environments are interactive with radiation, and therefore, which environments need be combined for irradiation testing. Those environments which are additive and those which are interactive with a radiation environment are defined. (auth)

3965
THERMOLUMINESCENCE AND COLORATION OF LITHIUM FLUORIDE PRODUCED BY ALPHA PARTICLES, ELECTRONS, GAMMA RAYS, AND NEUTRONS. Frederick F. Morehead and Farrington Daniels (Univ. of Wisconsin, Madison). J. Chem. Phys. 27, 1318-24(1957) Dec.

The coloration and thermoluminescence produced in LiF by 2 Mev alpha particles, by 2 Mev electrons, by 1 Mev gamma rays from Co^{60}, and by thermal neutrons are described. The energy initially required to produce an F center varies. It is about 700 ev for alpha, 140 ev for beta, 65 ev for gamma rays, and 65 ev for thermal neutrons. The amount of thermoluminescence light produced and the number of thermoluminescence peaks increased with the exposure to each of these radiations. The larger the radiation dosage, the greater is the fraction of thermoluminescence emitted at the higher temperatures. All of the thermoluminescence is related to the emptying of F centers, but only one photon is emitted as visible thermoluminescence for every 10^4 electrons removed from F centers. The optical and thermal decolorizations are discussed. (auth)

3966
LIFETIME MEASUREMENTS OF MINORITY CARRIERS IN DEUTERON IRRADIATED GERMANIUM CRYSTALS. Ryukiti R. Hasiguti, Etsuyuki Matsuura, and Shiori Ishino (Univ. of Tokyo). J. Phys. Soc. Japan 12, 1351-4(1957) Dec.

Minority carrier lifetimes were measured on the deuteron irradiated surfaces of n-type germanium crystals. Fictitiously long lifetimes were obtained which suggest the formation of a p-type thin layer by the deuteron irradiation. Etch figures were observed on the irradiated surfaces. (auth)

3967
LUMINESCENCE PRODUCED IN AIR BY POLONIUM-210 α-PARTICLES. R. W. Nicholls and E. M. Reeves (Univ. of Western Ontario, London, Can.). Nature 180, 1188-9 (1957) Nov. 30.

3968
RADIATION DAMAGE IN SOLIDS. Wilhelm Sander. Naturwissenschaften 44, 504-6(1957). (In German)

3969
STRUCTURAL BEHAVIOUR OF NEUTRON IRRADIATED QUARTZ. M. C. Wittels (Oak Ridge National Lab., Tenn.). Phil. Mag. (8) 2, 1445-61(1957) Dec.

X-ray and density studies have been made on single crystals of quartz irradiated with fast pile neutrons at approximately 100°C. The structural effects of the irradiation follow at least two processes with doses up to 1.2×10^{20} neutrons/cm^2. Crystals irradiated with less than 3×10^{19} neutrons/cm^2 expand anisotropically in a manner that is similar to the thermal expansion of unirradiated quartz. In this dosage range the volume increase is the same, as determined by x-ray and hydrostatic methods, and little or no distortion is observed in x-ray diffraction patterns. The model which seems to fit these results best consists of point defects and slightly disordered regions which result in an elastic distention of the lattice. After doses in excess of 3×10^{19} neutrons/cm^2 the damaging process is more complex since the volume change indicated by x-ray measurements of the host lattice becomes larger than the bulk volume change determined hydrostatically. After irradiation with 8×10^{19} neutrons/cm^2 an inhomogeneous shear strain is observed in the extreme skewing of the (22.0) reflection which is interpreted as being due to the crowding of oxygen ion interstitials into the open c-axis channels. Amorphous regions enmeshed in the host lattice are identified in crystals that still possess long range order after irradiation with 7×10^{19} neutrons/cm^2. The diffuse x-ray scattering halo associated with the amorphous material changes peak position, shape, and intensity with increasing dosages of irradiation. It is suggested that these changes result from a reorientation of disordered regions which is assisted by the increased expansion of the lattice and the presence of ruptured silicon–oxygen bonds. A second kind of diffuse scattering appears at these high doses which cannot be accounted for on the basis of a thermal origin but is probably related to scattering resulting from inhomogeneous lattice strains. In a complementary study it was found that coesite, a high density crystalline silica remained stable under neutron irradiation dosages which completely disorder quartz. These results indicate that the rate of damage in silica solids is structure dependent. (auth)

Radioactivity

3970 TID-7541(Pt. 1)
Division of Nuclear Materials Management, AEC.
AEC AND CONTRACTOR SOURCE AND SPECIAL MATERIALS MANAGEMENT REPRESENTATIVES MEETING. A Conference Held at Washington, D. C., June 17-19, 1957. 151p. $4.00(OTS).

A broad range of subjects of accounting and auditing, measurements and statistics in the control of SS materials was covered at this meeting. Topics discussed included: procedures for estimating random and systematic uncertainties of measurements; simplification of in-process accountability in uranium fuel element fabrication; methods of studying book-physical inventory differences; diversified application of basic accounting data; audit of SS material accounting records for a separation process; testing of high reliability in the nucleonic assay of MTR-ETR fuels; an optimum sampling technique; material control and handling in the fabrication of enriched UO_2–Al shim plates; analysis of measurement precisions; the chemist and tester performance evaluation program at the Idaho Chemical Processing Plant; quality control applied to sampling and analysis in chemical separations plants; inventory verification by isotopic dilution technique; a comparison of mass spectrometric and radiochemical methods for the determination of U^{235} burnup; a calculation of gaseous diffusion cascade dynamic inventory on the IBM 650; the determination of U^{235} in industrial waste solutions; and the measurement of uranium content in reactor fuel elements. (C.H.)

3971
LIFETIME OF THE 3.56 Mev STATE OF LITHIUM 6. H. J. Rose and E. K. Warburton (Brookhaven National Lab., Upton, N. Y.). Phil. Mag. (8) 2, 1468-71(1957) Dec.

3972
FURTHER EXPERIMENTS ON THE DECAY OF ^{202}Tl. H. C. Hamers, A. Marseille, and Th. J. De Boer. Physica 23, 1056-66(1957) Nov.

New investigations concerning the electron capture decay of Tl^{202} resulted in an estimation of the energy of the transition from the ground state of Tl^{202} to the 440 kev excited state of Hg^{202}. With the help of the theoretical results of Brysk and Rose this transition energy was found to be 599 ± 5 kev. It appeared that 39% of all the transitions go from ground to ground, it is likely that these transitions are of the unique first forbidden type. (auth)

3973
THE (ϵ/β^+) RATIO IN THE DECAY OF ^{48}V AND THE FLUORESCENT YIELD IN Ti. H. L. Hagedoorn and J. Konijn. Physica 23, 1069-72(1957) Nov.

The ratio of electron capture to positron emission in the decay of V^{48} has recently been measured by $\beta-\gamma$ coincidence measurements in a long lens β spectrometer. This paper reports additional measurements in a proportional counter in order to check the obtained results. A proportional counter filled with krypton was used in a slow coincidence arrangement with a NaI scintillation spectrometer. The pulses from the scintillation counter were delayed in order to take into account the delay in the proportional counter. The resolving time of the coincidence circuit was 2.4×10^{-6} sec. The ratio of true to accidental coincidences was in all measurements at least 20%. The scintillation spectrometer recorded the gamma ray photopeaks. The arrangement was tested by a measurement on Na^{22}. The fluorescent yield in titanium was also determined. (A.C.)

3974
INVESTIGATION OF CONVERSION LINES IN THE β-SPECTRUM OF A Eu^{152}–Eu^{154} MIXTURE. V. M. Kel'man, V. A. Romanov, R. Ia. Metskhvarishvili, and V. A. Koliunov (USSR Academy of Sciences). Soviet Phys. JETP 5, 24-30 (1957) Aug.

Internal conversion lines in the K shells and L and M subshells of Sm^{152} and Gd^{154} were measured with a high resolution β spectrometer. The ratios of the conversion coefficients were determined for 122 and 123.2 kev transitions. The energy intervals between the conversion lines were measured with high precision. (auth)

Rare Earths and Rare-earth Compounds

3975
PARAMAGNETIC RESONANCE IN NEODYMIUM NITRATES. T. I. Sanadze (Tbilisi State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 1042-3(1957) Oct. (In Russian)

Shielding

3976 CF-52-5-183(Del.)
Oak Ridge National Lab., Tenn.
CONTROL PLUG MOCKUP MEASUREMENTS; NEUTRON AND GAMMA DISTRIBUTION IN WATER CONTAINING

LEAD, STEEL, AND AIR. C. E. Clifford. May 26, 1952. Decl. with deletions May 19, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

Measurements were completed in the Lid Tank on the short experiment to aid in the design of control-instrument plugs. The plug was designed to increase the thermal-neutron flux locally in the water beyond the pressure shell. This was accomplished by penetrating the water reflector and the steel and water thermal shield with an 8-in. diameter steel pipe filled with lead, steel, or air. The measurements are compared with those of the unperforated shield. Neutron measurements were taken in water along the axis of the plug and also along the line perpendicular to and intersecting the plug axis. Gamma measurements were taken beyond the air-filled plug only. Neutron-induced secondary rays are predominant in determining the attenuation rate of the pressure shell. (D.E.B.)

3977 CF-53-11-53(Del.)
Oak Ridge National Lab., Tenn.
THE EFFECT OF SOME LIQUID-METAL DUCTS ON REACTOR SHIELDS. M. K. Hullings. Nov. 1953. Decl. with deletions Feb. 12, 1957. 63p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

A series of neutron attenuation experiments to test engineering mockups of liquid-metal ducts in reactor shields is reported. The experiments were performed in the thermal column of the ORNL Graphite Reactor for the purpose of acquiring sufficient data to facilitate calculations of additional shielding required by loss in efficiency in the reactor shield due to duct perforations. (K.S.)

3978 LA-2155
Los Alamos Scientific Lab., N. Mex.
NEUTRON FLUXES, GAMMA-RAY DOSE RATES, AND TEMPERATURES IN THE IRON–MAGNETITE CONCRETE SHIELD OF THE OMEGA WEST REACTOR. Avery M. Gage. Oct. 7, 1957. 84p. Contract W-7405-eng-36. $2.25(OTS).

Thermal and fast neutron fluxes were measured in the shield of the Omega West Reactor at Los Alamos with In foils and S pellets, respectively. The In foils and β counters were calibrated to a known flux of thermal neutrons in a graphite sigma pile. The S pellets and counters were calibrated to a known flux of 14.1 Mev neutrons from a T(d,n)He source. The measured effective decade length for the fast neutron flux is 8.1 in. The average Cd ratio is 2.4, varying from 2.1 to 2.6. The distribution of γ-ray dose rates, measured with dosimeters, has a decade length of 7.0 in. At the outer surface of the shield (4 ft of water and 5 ft of concrete) the fast neutron leakage is 0.1 neutrons/cm^2-sec and the γ-ray dose rate is 2.0 mr/hr for a reactor power of 10 Mw (extrapolated from measurements made at 840 kw). No heating of the concrete by γ rays and neutrons was observed at a power of 840 kw. Small anomalies in the distribution of temperature, thermal neutron flux, and Cd ratio are consistent with one another and suggest variations in concrete density. The Fe-magnetite concrete has an average specific gravity of 4.6 and contains (by weight): 75% Fe, 19% O, 3% Ca, 2% Si, 0.4% H, and 0.3% Al. (auth)

Spectroscopy

3979
HYPERFINE STRUCTURE IN THE MICROWAVE SPECTRUM OF WATER. I. QUADRUPOLE COUPLING IN DEUTERATED WATER. D. W. Posner (C.S.I.R.O., Univ. Grounds, Chippendale, N.S.W.). Australian J. Phys. 10, 276-85(1957).

Measurement of hyperfine structure in the microwave spectrum of D_2O gives $(eqQ)_{OD} = +353 \pm 4$ kc/s for the quadrupole coupling constant of the deuteron in the direction of the OD bond, and the corresponding electric field gradient is $q_{OD} = (\partial^2 V/\partial z^2) = (1.78 \pm 0.02) \times 10^{15}$ e.s.u. The observed hyperfine splitting of HDO is not accounted for by a simple quadrupole interaction and appears to require relatively large magnetic interaction terms for a complete description. (auth)

3980
VIBRATION-ROTATION SPECTRUM OF DEUTERIUM IODIDE. Llewellyn H. Jones (Los Alamos Scientific Lab., N. Mex.). J. Mol. Spectroscopy 1, 179-83(1957) Oct.

The fundamental and first overtone vibration-rotation bands of DI have been observed. The molecular constants are $\omega_e = 1640.14$, $x_e\omega_e = -20.16$, $B_e = 3.2840$, $\alpha_e = 0.06142$, and $D_v = 5.3 \times 10^{-5}$ cm^{-1}. These results are in good agreement with similar studies on HI as well as microwave and pure rotational spectra of DI. (auth)

3981
ON THE TYPICAL FORM OF THICK PLASMA SPECTRUM. I. (THEORETICAL FOUNDATION). H. Bartels and R. Buechelt. Z. Physik 149, 594-607(1957). (In German)

3982
ON THE TYPICAL FORM OF THICK PLASMA SPECTRUM. II. INTERPRETATION OF THE SPECTRAL RADIATION DENSITY DISTRIBUTION OF A THICK PLASMA AT SPARK DISCHARGE OVER A HIGH PRESSURE MERCURY ARC. H. Bartels and R. Beuchelt. Z. Physik 149, 608-23(1957). (In German)

Theoretical Physics

3983 NYO-2097
Rochester, N. Y. Univ.
THE RELATIVISTIC QUANTUM THEORY OF ELEMENTARY PARTICLE INTERACTIONS. Lectures given by P. T. Matthews. Notes compiled by A. Fujii. Oct. 2, 1957. 168p. Contract AT(30-1)-875. $25.80(ph OTS); $7.80(mf OTS).

The material presented is mainly concerned with some general conclusions on the properties of the relativistic interactions of elementary particles entirely independent of the perturbation approximation. (A.C.)

3984 AEC-tr-3011
ELEMENTARY PARTICLES AND THE FIELD. D. Blokhintsev. Translated from Uspekhi. Fiz. Nauk 42, 76-92(1950). 25p.

The relationship of the field and elementary particles as represented by modern quantum physics is discussed. (D.E.B.)

3985
THE NON-CONSERVATION OF PARITY AND ITS SIGNIFICANCE. C. Bloch. Bull. inform. sci. et tech. No. 1, 8-12 (1957). (In French)

3986
SLOW COLLISIONS BETWEEN HEAVY PARTICLES. D. R. Bates. Proc. Roy. Soc. (London) A243, 15-23(1957) Dec. 10.

Certain coupling terms neglected in the perturbed stationary state and related approximations for treating slow collisions between heavy particles are discussed. It is pointed out that their inclusion would make the group of approximations in question tend to the Born approximation at high impact energies and weak interactions. One member of the group differs from the Born approximation only in the coupling terms. Information on the importance of

these terms can hence be obtained by comparing the values of cross sections given by this member with the corresponding values given by the Born approximation. Calculations are carried out on the processes $H^+ + H(1s) \rightarrow H^+ + H(2p)$ and $H(1s) + H(1s) \rightarrow H(1s) + H(2p)$. (auth)

3987

ELECTRODYNAMICS OF CHARGED SCALAR PARTICLES. L. P. Gor'kov and I. M. Khalatnikov (Academy of Sciences, USSR). Soviet. Phys. JETP 4, 777-89(1957) July.

The behavior of the Green's function in the region of high momenta for the electrodynamics of spin-zero charged particles is investigated on the basis of the Kemmer formalism. (auth)

3988

ON THE DERIVATION OF THE FOKKER-PLANCK EQUATION FOR A PLASMA. S. V. Temko. Soviet Phys. JETP 4, 898-903(1957) July.

The Fokker-Planck equation for a many-component plasma is derived by the method of N. N. Bogoliubov, and the coefficients are calculated in explicit form. (auth)

3989

THE THREE BODY PROBLEM FOR SHORT RANGE FORCES II. G. V. Skorniakov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 910-17(1957) July.

An iteration method is proposed for finding the wave function and binding energy of a three body system for the case of short range forces. The method is applied to the ground state of H^3. (auth)

3990

ON THE DAMPING THEORY OF PARTICLE SCATTERING BY A FIXED CENTER. A. A. Sokolov and B. K. Kerimov (Moscow State Univ.). Soviet Phys. JETP 4, 921-2(1957) July.

3991

A STATIC SOLUTION OF THE NONLINEAR MESON EQUATION. V. G. Iaichnitsyn (Dniepropetrovsk State Univ.). Soviet Phys. JETP 4, 925-6(1957) July.

3992

ON THE HYDRODYNAMIC DESCRIPTION OF PLASMA OSCILLATIONS. B. B. Kadomtsev. Soviet Phys. JETP 4, 926-8(1957) July.

3993

THE VARIATIONAL PRINCIPLE AND THE VIRIAL THEOREM FOR THE CONTINUOUS DIRAC SPECTRUM. Iu. V. Novozhilov. Soviet Phys. JETP 4, 928-30(1957) July.

A generalization of the variational principle for all scattering amplitudes to the case of the Dirac equation is presented, and the virial theorem for the continuous Dirac spectrum is derived. The results can be applied to the theory of high-energy electron scattering by nuclei. (L.T.W.)

3994

THE INTERNAL COMPTON EFFECT. E. G. Melikian (Moscow State Univ.). Soviet Phys. JETP 4, 930-1(1957) July.

A general formula is derived for the relative probability of the Compton effect for both magnetic and electric transitions in the Born approximation, and numerical calculations are carried through for some specific cases. (L.T.W.)

3995

GENERALIZED NONSINGULAR SOLUTIONS FOR THE SCALAR MESON FIELD OF A POINT CHARGE IN GENERAL RELATIVITY THEORY. Duan'-I-Shi (Moscow State Univ.). Soviet Phys. JETP 4, 935-7(1957) July.

An attempt is made to find solutions to the equations of the general relativistic gravitational and scalar meson fields of a point nuclear charge. The solution is nonsingular at all points of the gravitational and meson fields. Although it contains several functions whose form is not given, this solution can be used to obtain the potential of the scalar meson field, which is a generalization of the Yukawa potential; furthermore, it becomes possible to calculate the mass and self-energy of the nucleon, which turn out to be finite. (L.T.W.)

3996

THE OPTICAL THEOREM AND ELASTIC SCATTERING THROUGH SMALL ANGLES. L. I. Lapidus (United Inst. of Nuclear Research). Soviet Phys. JETP 4, 937-9(1957) July.

3997

PERTURBATION THEORY FOR THE ONE DIMENSIONAL QUANTUM MECHANICAL PROBLEM AND THE LAGRANGE METHOD. Ia. B. Zel'dovich (Academy of Sciences, USSR). Soviet Phys. JETP 4, 942-4(1957) July.

3998

ON QUANTITIES WITH ANOMALOUS PARITY AND ON A POSSIBLE EXPLANATION OF PARITY DEGENERACY OF K-MESONS. I. M. Gel'fand and M. L. Tsetlin. Soviet Phys. JETP 4, 947-9(1957) July.

3999

γ-γ ANGULAR CORRELATION IN TRANSITIONS OF MESIC ATOMS. V. A. Dzhrbashian (Academy of Sciences, Armenian SSR). Soviet Phys. JETP 4, 949-51(1957) July.

The possibility of determining the spin of a muon by using data on the γ-γ angular correlation in transitions of mesic atoms is examined. A method is also proposed of verifying the spins of nuclei for which $I = 0$ is doubtful or has been obtained only from theoretical considerations unsupported by evidence. The formulas derived can be used to determine the spins of all types of mesons. (L.T.W.)

4000

ON THE CONSTRUCTION OF THE SCATTERING MATRIX. II. THE THEORY WITH NON-LOCAL INTERACTION. B. V. Medvedev (Academy of Sciences, USSR). Soviet Phys. JETP 5, 48-57(1957) Aug.

N. N. Bogoliubov's method for constructing the scattering matrix is generalized to the case of a theory with nonlocal interaction. For such a theory, a scattering matrix is constructed which satisfies the physically necessary requirements. (auth)

4001

QUANTUM CORRECTIONS TO THE THOMAS-FERMI EQUATION. D. A. Kirzhnits (Academy of Sciences, USSR). Soviet Phys. JETP 5, 64-71(1957) Aug.

The operator form of the Hartree–Fock equation is considered. The Thomas–Fermi and the Thomas–Fermi–Dirac equations are obtained in the zeroth approximation in terms of $\hbar$. Quantum corrections were found by the operator method for the Thomas–Fermi equations of 2nd and 4th order in $\hbar$. The correction of 2nd order is compared with the Weizsacker correction and it is shown that the latter is 9 times larger than the quantum theory value. The resultant equations are applied to the computation of the total energy of the atom. (auth)

4002

MULTIPLE INTERACTION HAMILTONIANS IN QUANTUM ELECTRODYNAMICS. G. F. Filimonov and Iu. M. Shirokov (Moscow State Univ.). Soviet Phys. JETP 5, 84-8(1957) Aug.

A method is described for constructing electromagnetic interaction Hamiltonians of a many-particle system,

based on the usual Hamiltonian formalism. For illustration the Hamiltonian for the pair interaction of spinor particles is derived. (auth)

4003
QUANTUM FIELD THEORETICAL SOLUTIONS WITHOUT PERTURBATION THEORY. V. I. Grigor'ev (Moscow Petroleum Inst.). Soviet Phys. JETP 5, 109-11(1957) Aug.

4004
ENERGY SPECTRUM OF CASCADE PHOTONS IN LIGHT SUBSTANCES. I. P. Ivanenko and M. A. Malkov (Moscow State Univ.). Soviet Phys. JETP 5, 112-14(1957) Aug.

The energy spectrum of cascade photons in light substances was calculated using the system of polynomials orthogonal in the interval (0, ∞). The results of the calculation of the number of photons in a shower initiated by a primary electron or photon in air are given for certain values of the energy and time. (L.T.W.)

4005
ON THE SYSTEMATIZATION OF THE STRONGLY INTERACTING PARTICLES. Masakuni Ida (Univ. of Kyoto). Progr. Theoret. Phys. (Japan) 17, 733-4(1957) May.

4006
SELECTION RULE IMPOSED BY MASS REVERSAL. Tadashi Ouchi (Hiroshima Univ.). Progr. Theoret. Phys. (Japan) 17, 743-50(1957) June.

The author has investigated the structure of the interactions among the fundamental particles by means of a selection rule based on the new invariance principle, the mass reversal. A unified model of interactions for the baryon-meson system is presented, and its consistency is proved using this selection rule. This selection rule will be useful for exploring the dynamical structure of the interaction. (auth)

4007
INVESTIGATION OF THE CHEW-LOW EQUATION BY ITERATION. Haruyuki Fujino and Jun'ichi Osada (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 17, 751-64(1957) June.

Chew-Low equation of P-wave meson-nucleon scattering is investigated by iteration method to give the recipe to obtain the values of Feynman diagrams without any renormalization procedure. At the same time, the physical meaning of one-meson approximation of Chew-Low equation is made clear. (auth)

4008
ON THE ASYMPTOTIC CONDITIONS IN QUANTUM FIELD THEORY. Kazuhiko Nishijima. Progr. Theoret. Phys. (Japan) 17, 765-802(1957) June.

In this paper the so-called asymptotic conditions are introduced in a different way than usually done, thereby making use of Heisenberg operators alone. These conditions are regarded as the defining equations for a complete set of state vectors, either incoming or outgoing wave states. By closely examining the self-consistency of these defining equations, a set of integral equations for the vacuum expectation values of retarded products of operators is found. The unitarity condition of the S matrix is one of the inevitable consequences of these equations. These integral equations are essentially equivalent to those given by Chew and Low, and also independently by Lehmann, Symanzik, and Zimmermann. The advantage of the new integral equations over the older ones of the above mentioned authors consists in that the new ones are manifestly covariant in form and also in that all quantities appearing in the equations are related only to connected Feynman diagrams in contrast to the T products. The possibility to extend the present formalism so as to include the bound states is also discussed. Finally it is shown in the perturbation theory that these integral equations are satisfied only by the renormalized solutions of the renormalizable field theories provided that the microscopic causality condition is imposed as the boundary condition. (auth)

4009
INTERPRETATION ON THE RATIO OF THE EMISSION PROBABILITIES FOR PROTONS AND NEUTRONS. Ryuzo Nakasima (Osaka Univ.) and Ken Kikuchi (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 17, 816-17(1957) June.

4010
A GROUP THEORETICAL CONSIDERATION OF THE FIRST PRINCIPLES OF RELATIVISTIC QUANTUM MECHANICS. I. THE GENERAL PROPERTIES OF THE INHOMOGENEOUS LORENTZ GROUP. Yu. M. Shirokov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 861-72(1957) Oct. (In Russian)

A group theoretical investigation is made of the possibilities of relativistic quantum mechanics, which is not based on any concrete form of equations of motion. An examination is made of certain general properties of group representations as well as of a number of the specific properties of the representations of an inhomogeneous Lorentz group. (tr-auth)

4011
NUCLEAR FORCES AND THE SCATTERING OF π-MESONS. Yu. V. Novozhilov (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 33, 901-9(1957) Oct. (In Russian)

The interaction is considered of two bound nucleons in pseudoscalar meson theory with pseudovector coupling. The principal part of the functional of the two-nucleonic state is represented in the form of the product of single-nucleonic functionals. Consideration is given only to a state without real mesons and with one real meson. The procedure is developed of reducing two-nucleonic renormalized matrix elements to single-nucleonic ones, which are then calculated by the method of Chew, Low, and Wick. The potential of order $\exp(-2R)$ is calculated. It consists of two parts: one part is proportional to f^4 (f is the interaction constant), and the other is a function of the phases of π-meson scattering on nucleons. (tr-auth)

4012
ON THE METHOD OF «SECONDARY QUANTIZATION» IN PHASE SPACE. Yu. L. Klimontovich (Moscow State Univ.). Zhur. Eksptl'. i Teoret Fiz. 33, 982-90(1957) Oct. (In Russian)

As independent variables in the statistical description of processes in systems of interacting particles, use is made of particles in various points of phase space of coordinates and momenta, which for any point of phase space are random functions of time. For these functions there are given the classical and quantum equations, from which, by averaging over their distribution, functions chains of equations are obtained for classical and quantum distribution functions. To illustrate the possible use of this method expressions are obtained for excitation spectrum and the correlation function for a system of particles with central interaction for the case when close interactions are not essential. This method is convenient for considering systems of particles in electromagnetic interaction. This method may be generalized for the relativistic case. (tr-auth)

Uranium and Uranium Compounds

4013
STUDIES OF URANIUM MINERALS. XXIII. TORBERNITE, ZEUNERITE AND URANOSPHERITE. Robert Berman

(Harvard Univ., Cambridge Mass. and U. S. Geological Survey, Washington). Am. Mineralogist 42, 905-8(1957) Nov.-Dec.

An attempt was made to synthesize the fully hydrated (8 to 12 H_2O) form of torbernite. Under the petrographic microscope the precipitate was found to be microcrystalline, with low birefringence and extinction visible on some of the grains. The d-spacings are analogous to the spacings of fully hydrated zeunerite and autunite and to less hydrated species of torbernite group. The zeunerite is the arsenate analogue of torbernite. Some specimens of green crystals identified as zeunerite from Weisser Hirsch mine, Schneeberg, Saxony were studied in comparison to artificial torbernite and materials from the Dexter mine, San Rafael Swell, Utah. The uranospherite is a secondary mineral formed with various arsenates in the oxidized zone of a vein (Weisser Hirsch mine near Scheeberg, Saxony) carrying uraninite, natural bismuth, and cobalt–nickel arsenides. The mineral is a hydroxide or hydrated oxide of bismuth and hexavalent uranium, its formula is uncertain. The specimen was studied as to optical properties. (R.V.J.)

4014

A NOTE ON PREFERRED ORIENTATIONS IN URANIUM AS DETERMINED BY DILATOMETRIC STUDIES. Steinar Aas (Joint Establishment for Nuclear Energy, Kjeller, Norway). Tidsskr. Kjemi, Bergvesen Met. 17, No. 5, 77-9 (1957).

Uranium metal has been reduced 80% in thickness by rolling. The thermal dilations of the finished plates have been determined and correlated with theoretical dilations, calculated by assuming various types and degrees of preferred orientations. The results confirm that a (010)—(110) double texture develops at rolling temperatures just below the recrystallization point. β-treatment does not give completely randomly oriented metal. Cross rolling changes the developed textures which are again dependent upon the exact rolling schedule. (auth)

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 6 March 31, 1958

GENERAL

4015 TID-5059(3rd Rev.)
Technical Information Service Extension, AEC.
CORPORATE AUTHOR ENTRIES USED BY THE TECHNICAL INFORMATION SERVICE IN CATALOGING REPORTS. Frances E. Stratton, ed. Nov. 1957. 305p. $6.50(OTS).

Atomic Bombs and Warfare

4016 ITR-1447
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE INTERNAL ENVIRONMENT OF UNDERGROUND STRUCTURES SUBJECTED TO NUCLEAR BLAST. I. THE OCCURRENCE OF DUST. Preliminary Report. Clayton S. White, Mead B. Wetherbe, and Vernon C. Goldizen. Sept. 1957. 69p. $2.00(OTS).

The possible occurrence of dust inside protective shelters as a consequence of nuclear explosions was studied using 18 underground structures subjected to atomic detonations during Operation Plumbbob at distances ranging from 4320 to 840 ft from Ground Zero. The existence of considerable dust was established using sticky-tray fallout collectors. Particulates captured arose from dust on the floor existing preshot, from dust leaks in some shelters, and from the internal surfaces of the structures. The latter was established by treating the walls and ceilings of selected shelters with a fluorescent dye solution and subsequently demonstrated fluorescence of captured particles. Data available indicate that the dust-collector technique will be useful in evaluating the environmental aspects of shelters tested in the future and that procedures showing fine spalling may be more sensitive indicators of structural response to dynamic loading than gross spalling. Should this indeed be established, the fluorescent method employed, or an equivalent, will become another simple routine test available to indicate structural response at greater ranges than is now possible without using complicated instrumentation. (auth)

4017 ITR-1451
Ammann and Whitney, New York.
RESPONSE OF PROTECTIVE VAULTS TO BLAST LOADING. Preliminary Report. E. Cohen and E. Laing. Sept. 1957. 39p. Project 30.4 [of] OPERATION PLUMBBOB.

A reinforced-concrete steel-plate-lined vault and steel vault door were exposed to a nuclear detonation. The recorded peak incident pressure at the structure was approximately 92 psi. To aid postshot analyses, soil borings were made to obtain undisturbed samples for determining soil characteristics. Preshot and postshot field surveys were made to determine the total lateral and vertical displacement of the structure. Blast instrumentation consisted of Wiancko shock pressure gauges and a dynamic-pressure gauge. Structural response was not recorded. Thermal instrumentation consisted of a thermocouple on the front face of the vault, two peak-temperature gauges, and a spring-wound stylus 24-hr temperature recorder on the interior of the vault. Radiation measurements were made using film dosimeters and gamma-radiation differential chemical dosimeters. (auth)

4018 ITR-1469
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
TERTIARY EFFECTS OF BLAST — DISPLACEMENT. Preliminary Report. R. V. Taborelli and I. G. Bowen. Sept. 1957. 36p. Project 33.3 [of] OPERATION PLUMBBOB. $1.00(OTS).

Measurements were made of the velocity and distance of translation of anthropomorphic dummies and equivalent spheres caused by blast winds. The primary technique for recording the movement of these objects was photo-triangulation. The secondary technique (applicable to certain of the equivalent spheres) was to have the spheres impelled into missile traps. The resultant penetration provides a means for determining the velocity at the time of impact. Analysis of the results from both the primary and secondary techniques is expected to provide some of the information identified in the objective. (auth)

4019 ITR-1507
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
THE INTERNAL ENVIRONMENT OF UNDERGROUND STRUCTURES SUBJECTED TO NUCLEAR BLAST. II. EFFECTS ON MICE LOCATED IN HEAVY CONCRETE SHELTERS. Preliminary Report. D. R. Richmond, T. L. Chiffelle, R. T. Sanchez, and J. D. Ward. Sept. 1957. 29p. Project 33.6 [of] OPERATION PLUMBBOB. $1.00 (OTS).

Mice were used to assess biologically the inside environment of two designs of heavy concrete personnel structures subjected to nuclear blast. A sample consisted of 20 mice; one sample was used in each of 12 structures. Aside from two samples placed in unrealistic locations, there was no immediate mortality. By D+20 days two mice from the close-in shelters and seven from those further out had died. (auth)

Atomic Power

4020 WASH-740
Division of Civilian Application, AEC.
THEORETICAL POSSIBILITIES AND CONSEQUENCES

OF MAJOR ACCIDENTS IN LARGE NUCLEAR POWER PLANTS. Mar. 1957. 114p. $0.65(GPO).

Assuming a typical power reactor of 500 tMw in a characteristic location, theoretical calculations were made of the effects of the worst possible reactor accidents. Both personal and property damage as a result of the initial accident and the subsequent fission product release are evaluated. The possibility of a catastrophic reactor accident was also evaluated and found to be extremely unlikely. (D.E.B.)

4021

THIRD PARTY LIABILITY IN NUCLEAR INDUSTRY. P. Sacerdoti. Energia nucleare (Milan) 6, 495-511(1957) Dec. (In Italian)

Following a general review of the safety and hazards problems in nuclear industry and research, the problem is dealt with from an insurance point of view. All questions concerning limits and costs of coverages on behalf of private companies, limits of liability in time, legal limits of operators' liability are examined. (auth)

4022

HOW WE FIND SITES FOR NUCLEAR POWER STATIONS. G. N. Stone (Central Electricity Generating Board). New Scientist 3, 26-9(1958) Jan. 2.

A number of factors such as water supply, abundance of coal, and population, which influence the location of nuclear power stations in England are reviewed. (D.E.B.)

4023

ECONOMICS OF ATOMIC ENERGY. Mary Goldring. London, Butterworths Scientific Publications, 1957. 193p.

The growth of Britain's nuclear power is discussed. The volume is broken down into three parts which are: the atomic industry (the atomic factories, the tools of industry, and the scale of investment); atomic power (the need for power, cost of atomic power, and export market); and atomic investment (British pattern, atoms and industry, other countries methods, and Britain's atomic future). (W.L.H.)

4024

THE APPLICATION OF ATOMIC ENGINES IN AVIATION. Edited by V. A. Mikhailov. Military Publishing House of the Department of Defense. Moscow, 1957. 167p. (In Russian)

A compilation of published data on applications of nuclear power plants in aviation and in rockets is given in popular form. Various aspects of nuclear reactors—their performance, the fuels used, and their prospective applications in aviation and in interplanetary flight—are discussed. The flight of aircraft propelled by chemical and nuclear energy and the complications involved in construction of nuclear aircraft reactors are analyzed. Designs of aviation nuclear power plants are shown, including rocket engines, air-cooled engines, turbojets, turboprops, etc. Radiation hazards and protection involved in nuclear powered aircraft and servicing problems in flight as well as the nuclear aircraft take-off and landing characteristics are described. Interplanetary flight, altitude and speed performances, advantages of nuclear rocket engines, and a program for attaining cosmic velocities are discussed. (R.V.J.)

Research Programs

4025 NP-6529

Australia. Commonwealth X-Ray and Radium Lab., Melbourne.

ANNUAL REPORT FOR THE YEAR ENDED JUNE 30, 1957. D. J. Stevens. Sept. 1957. 22p.

The Commonwealth X-ray and Radium Laboratory serves as the national center for radiological physics in Australia. The Laboratory provides advisory services on physical problems arising in the use of radium, x rays, and radioisotopes and also serves as a repository and dispersing center for radium, radon, and radioisotopes. Activities engaged in during the period are summarized. (C.H.)

BIOLOGY AND MEDICINE

4026

EFFECT OF ARTIFICIAL CHANGES IN EGG COMPOSITION ON HATCHABILITY AND CHICK GROWTH. Arthur H. Smith, Ursula K. Abbott, and Muriel E. Jones (Univ. of California, Davis). Proc. Soc. Exptl. Biol. Med. 97, 17-20(1958) Jan.

Radiation Effects

4027 AD-123944

Michigan. Univ., Ann Arbor. Fission Products Lab.

GAMMA-RAY SPROUT INHIBITION OF POTATOES. Report No. 10 (Annual) [for] Period November 1, 1955–October 31, 1956. L. E. Brownell. 94p. Project No. 7-84-01-002. Contract DA-19-129-qm-349.

Sebago variety potatoes given as little as 5,000 rep of γ radiation show no signs of sprouting, but Russett Rurals given 20,000 rep show occasional evidence of arrested sprout development. Tiny sprouts (1 mm) form but do not proliferate. Nonirradiated potatoes, except those stored at 35°F, show definite sprout development. Most of the potatoes, irradiated and nonirradiated, except those stored at 35°F, show slight softening, usually confined to the skin. Weight losses during storage for irradiated and control Sebago and Russet Rural variety potatoes were determined as a function of radiation dose, temperature of storage, and duration of storage. 19 references. (auth)

4028 AF-SAM-57-150

Texas. Univ., Austin. Radiobiological Lab. and School of Aviation Medicine, Randolph AFB, Tex.

POSTIRRADIATION CREATINURIA IN MACACA MULATTA MONKEYS. George M. Krise, Clyde M. Williams, and Donald R. Anderson. June 25, 1957. 4p.

Four adult male Macaca mulatta monkeys were placed on a creatine-free diet for seven to nine days. After the urinary level of creatine excretion had reached a plateau, the animals were irradiated with 1,000 rep of x rays. A creatinuria of approximately four times normal was excreted over the first four days in a pattern similar to that previously found in the rat. On the second postirradiation day the average creatinuria was about seven times normal. This effect is compared with other species reported in the literature. (auth)

4029 AF-SAM-58-1

Northwestern Univ., Chicago. Medical School.

EFFECTS OF SINGLE AND OF SPACED, MULTIPLE DOSES OF COBALT-60 GAMMA AND FISSION NEUTRON RADIATION ON THE INCORPORATION OF IRON-59 INTO THE RAT ERYTHROPOIETIC SYSTEM. W. A. Rambach, J. A. D. Cooper, and H. L. Alt. July 5, 1957. 17p.

4030 AMRL-273

Army Medical Research Lab., Fort Knox, Ky.

THE ROLE OF CERTAIN ORGANS IN FRACTIONATED TOTAL BODY X-IRRADIATION STUDIES. J. G. Kereiakes, W. H. Parr, and A. T. Krebs. Oct. 22, 1956. 14p. Project No. 6-59-08-014. (AD-125586).

Intervals between each of five 140 r doses of 1, 3, 5, 7, and 9 hours resulted in survivals of 15, 35, 55, 45, and 40%, respectively, for fractionated total-body x irradiation of

mice. A 700 r single dose was 100% lethal. The pattern of the intestinal dry weight response to fractionated doses was similar to that for survival. Fractionating the dose did not seem to significantly alter the 700 r single dose spleen wet weight value. The findings suggest that the fast recovery of the mitotic process and of the nucleic acid metabolism in the small intestine at about five hours after irradiation with doses between 100 and 200 r may be responsible for the observed results for the five hour interval fractionated total-body x irradiated mice. (auth)

4031 NP-6532

Office of the Adjutant General, Washington, D. C.
FOOD PRESERVATION IN THE ATOMIC AGE. A Selected List of Titles. [1956]. 10p.

Bibliographic Series No. 3.

A list of over 100 titles was compiled covering general aspects of preserving food by means of irradiation. Most of the papers have been published since 1952. (C.H.)

4032 NYO-2081

Columbia Univ., New York. Radiological Research Lab.
ANNUAL REPORT ON RESEARCH PROJECT. July 1, 1957. 128p. Contract AT-30-1-GEN-70.

Radiological Physics. Measurements of the tissue doses produced by radioisotopes variously distributed were continued. The average energy lost by S^{35} β rays per ion pair produced, or W, was determined to be 33.6 ± 0.3 ev. The value of W for water vapor relative to air was measured for β rays from S^{35} and from Ni^{63}. A new method for determining the disintegration rate of K-capture isotopes from their γ rays was tested with Au^{198}. A tissue-equivalent ionization chamber was developed and tested. Progress was made in applications of tissue equivalent ionization chambers for neutron dosimetry. Investigations were made of the mechanism of production of spontaneous and radioinduced mutants in E. coli. Radiobiology. Research in progress is summarized briefly. Progress is reported in studies on the protective effect of splenic plasma injected intraperitoneally into irradiated rabbits; the effect of hibernation and tranquilizing drugs on radiosensitivity of mice; the effect of radiation on the gonads in mice; and the effects of radiation on the developing mouse fetus. Lists are included of research published and submitted for publication during the period. (For preceding period see NYO-4698.) (C.H.)

4033 UR-493

Rochester, N. Y. Univ. Atomic Energy Project.
STUDY OF SMALL AREA SUB-FABRIC FLASH BURNS. K. M. Berkley. Aug. 29, 1957. 36p. Contract W-7401-eng-49. $1.00(OTS).

In a series of 1850 exposures with a modified 24-in. carbon arc searchlight, the influence of two cotton poplin fabrics alone and in combination with underwear material on the energy required to produce 2+ cutaneous burns in swine were studied. Impregnation of both khaki and green poplin with fire retardant material reduced the amount of energy necessary to produce a 2+ burn below that required with the untreated material, when the fabrics were spaced 2 and 5 mm from the skin. As a fabric is separated from the skin, the amount of absorbed energy required to produce a 2+ sub-fabric burn increases in a linear relationship with the amount of spacing. Maximum protection was provided by a two layer combination of poplin and underwear separated by a 5 mm air space. The energy required to produce a 2+ burn beneath two fabric layers separated by 5 mm decreased as the exposure time increased. With two layers spaced 2 mm, the requirements were the same. (auth)

4034 UWFL-49

Washington. Univ., Seattle. Applied Fisheries Lab.
RADIOACTIVITY IN THE REEF FISHES OF BELLE ISLAND ENIWETOK ATOLL APRIL 1954 TO NOVEMBER 1955. Arthur D. Welander. May 17, 1957. 42p. Contract AT(45-1)-540. $1.25(OTS).

Studies of the radioactivity in reef fishes of Belle (Bogombogo) Island, Eniwetok Atoll, were made during a period of about one year following the atomic detonations in 1954. Thirty-four different collections were made and 693 specimens were analyzed to determine the trend or decline of radioactivity. The decline of radioactivity during the period under study was generally similar in all species. The relative amount of radioactivity per gram of tissue was greatest in the alimentary tract, with the liver, skin, bone and muscle having successively lesser amounts. This relationship prevailed throughout the period. The rate of decline was greatest during the first 100 days, with a loss of 90% of the radioactivity during the period. Studies were made on the variation of total radioactivity in the tissues and species, on comparisons of the amount of radioactivity in the species and in their food, and on comparisons of the decline of radioactivity during the period with the decay of radioactivity in tissues collected soon after the shots. (auth)

4035 AEC-tr-3089

STUDIES ON LEUCOCYTOSIS AND LEUCOPENIA OBSERVED ON THE BASIS OF THE MITOSIS OF NUCLEATED CELLS IN THE BONE MARROWS. Tokuji Miyamoto. Translated from Acta Haematol. Japan. 18, 647-58(1955). 41p.

4036 NP-tr-10

EFFECTS OF RADIOACTIVE GOLD (Au-198) ON THE BONE MARROW. Theodor M. Fliedner and Rudolf Stodtmeister. Translated by B. Smith from Strahlentherapie 101, 289-95(1956). 5p.

4037 NP-tr-11

THE HAEMATOLOGICAL BASIS FOR THE ESTIMATION OF RADIATION SHIELDING PRECAUTIONS. Three Years of Radiation Haematological Research at the Czerny Hospital, Heidelberg University. R[udolf] Stodtmeister, Theodor M. Fliedner, and S. Sandkühler. Translated by B. Smith from Strahlentherapie 101, 296-307(1956). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3291.

4038 NP-tr-12

THE SIGNIFICANCE OF PARIETAL VESSEL LESIONS FOR HAEMATOPOIESIS INJURY TO RATS AFTER TOTAL BODY IRRADIATION OF 15 MeV ELECTRONS. R[udolf] Stodtmeister, S. Sandkühler, and Theodor [M.] Fliedner. Translated by B. Smith from Strahlentherapie 101, 308-17 (1956). 10p.

4039 NP-tr-17

THE EFFECT OF ULTRA-VIOLET RAYS ON THE ALBUMEN SUBSTANCES OF MILK SERUM. Theodor Fr. Hellbrugge, Lotte Scheid-Seydel, and Hubert Martin. Translated by F. Hudswell from Z. Kinderheilk. 70, 1-9(1951). 13p.

4040 NP-tr-21

THE EFFECT OF X-RAYS ON INTERNAL ORGANS. H. Heineke. Translated by F. Hudswell from Münch. med. Wochschr. 51, 785-6(1904). 6p.

4041

EFFECT OF X-IRRADIATION ON THE FUNCTION OF ADRENAL AUTOTRANSPLANTS IN THE RAT. Leland C. Wyman, Rae Whitney, Ralph F. Goldman, Patricia L.

Griffin, and Donald I. Patt (Boston Univ., Mass.). Am. J. Physiol. 192, 51-7(1958) Jan.

4042
TUMOR OF THE BONE TISSUE INDUCED BY RADIOACTIVE SUBSTANCES. N. N. Litvinov. Bull. Exptl. Biol. Med. (U.S.S.R.) 41, 703-7(1956) Aug.

4043
CHANGE IN CEREBELLUM TISSUE METABOLISM WITH IRRADIATION BY X-RAYS. A. V. Golubtsova, E. V. Moiseenko, and M. I. Safronova (M. V. Lomonosov State Univ., Moscow). Bull. Exptl. Biol. Med. (USSR). 41, 763-6(1956) Sept.

4044
ACCELERATION OF ORGAN FORMATION IN PLANTS BY X RADIATION. I. M. Vasil'ev (Inst. of Biological Physics, Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 401-3(1957) Sept. 21. (In Russian)

4045
EFFECTS OF X RADIATION ON THE DUODENUM AND THE INTRAMURAL GANGLIA OF PLEXUS MYENTRICUS (AUERBACHI) AND PLEXUS SUBMUCOSUS (MEISSNERI). L. B. Levinson, N. V. Pankova, and N. I. Shapiro. (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 116, 404-6(1957) Sept. 21. (In Russian)

Studies were made of the order of the alterations in the nerve tissues induced by radiation in various organs. Comparisons were made of the charges taking place in the epithelium capillary cells, in the Brunner glands, and in the nerve cells in the intestinal intramural ganglia. Changes in the nerve cells induced by exchange disturbances were studied in mice, and determination was made of the dis-oxyribonucleic acid, ribonucleic acid, and alkali and acid phosphatase. (R.V.J.)

4046
EFFECTS OF POTASSIUM CYANIDE ON THE SURVIVAL OF IRRADIATED ANIMALS. N. V. Luchnik and E. A. Timofeeva-Resovskaya (Inst. of Biology, Urals Acad. of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 116, 407-10(1957) Sept. 21. (In Russian)

4047
THE CYTOLOGY OF THE IRRADIATED OVARY OF DROSOPHILA MELANOGASTER. R. C. King (Northwestern Univ., Evanston, Ill.). Exptl. Cell Research 13, 545-52(1957) Dec.

4048
EFFECTS OF ANDROGENS ON THE CYTOLOGY OF X-IRRADIATED SEMINAL VESICLES. W. Fleischmann (Veterans Administration Hospital, Memphis, Tenn.). Exptl. Cell Research 13, 604-7(1957) Dec.

4049
DYE UPTAKE AND SURVIVAL STUDIES IN X-IRRADIATED YEAST CELLS. A. J. Luzzio and J. G. Kereiakes (U.S. Army Medical Research Lab., Fort Knox, Ky.). Exptl. Cell Research 13, 615-17(1957) Dec.

4050
IONIZING RADIATION AND HUMAN HEREDITY. N. P. Dubinin (Laboratory of Radiation Genetics, Inst. of Biophysics, Acad. of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Biol., 743-55(1957) Nov.-Dec. (In Russian)

4051
FATE OF SKIN HOMOGRAFTS IN X-IRRADIATED MICE TREATED WITH HOMOLOGOUS MARROW. Joan M. Main and Richmond T. Prehn (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 19, 1053-64(1957) Dec.

4052
AMYLOIDOSIS IN MICE EXPOSED TO DAILY GAMMA IRRADIATION. S. Lesher, D. Grahn, and A. Sallese (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 19, 1119-31(1957) Dec.

4053
LONG-TERM STUDY OF X-IRRADIATED RABBITS WITH BONE-MARROW HOMOTRANSPLANTS. K. A. Porter and J. E. Murray (Harvard Medical School and Peter Bent Brigham Hospital, Boston, Mass.). J. Natl. Cancer Inst. 20, 189-205(1958) Jan.

4054
HYPERLIPOPROTEINEMIA AND CHOLESTEROL DEPOSITION AT THE ARTERIES OF I^{131}-TREATED DOGS. Lawrence J. Milch, A. A. Renzi, Norman Weiner, Lealy G. Robinson, and Sherman S. Wilson (Randolph Air Force Base, Texas). Proc. Soc. Exptl. Biol. Med. 97, 56-9(1958) Jan.

4055
URINARY EXCRETION OF URIC ACID AND ALLANTOIN IN THE X-IRRADIATED-ADRENALECTOMIZED RAT. Kenneth L. Jackson and Cecil Entenman (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Proc. Soc. Exptl. Biol. Med. 97, 184-6(1958) Jan.

4056
POTENTIATING EFFECTS OF PRENATAL X-IRRADIATION ON DENTAL CARIES IN THE RAT. B. H. Ershoff and L. A. Bavetta (Univ. of Southern California, Los Angeles). Proc. Soc. Exptl. Biol. Med. 97, 202-5(1958) Jan.

Radiation Hazards and Protection

4057 APEX-348
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
METHOD OF ESTIMATING DOSAGE TO GROUND FROM A RADIOACTIVE CLOUD. C. C. Gamertsfelder and R. L. Waterfield. Oct. 1955. 27p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.00(OTS).

Beginning with Sutton's diffusion equation, the authors develop mathematical expressions for the radiation dose to a point on the ground following the instantaneous emission of a point source of radiation. From a knowledge of weather conditions, reactor running history, and the power of the runaway, one can compute the beta and gamma dose to be expected from the following events: material inhaled into the lung; direct and scattered radiation from material in the air; and direct and scattered radiation from material deposited on the ground by rain-out or fall-out. (auth)

4058 KAPL-1869
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR APRIL, MAY, JUNE 1957. 40p. Contract W-31-109-Eng-52. $1.25(OTS).

Routine personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1831.) (C.H.)

4059 KAPL-1889
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR JULY, AUGUST, SEPTEMBER 1957. 43p. Contract W-31-109-Eng-52. $1.25(OTS).

Personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1869.) (C.H.)

4060 NAVSHIPS-250-348-1
Bureau of Ships.
GENERAL PRINCIPLES OF IONIZING RADIATION. Roger G. Preston. June 1, 1955. 37p.

This information is intended for personnel only occasionally associated with the fields of nuclear power and atomic warfare. These notes are divided into three chapters: the nature of ionizing radiation, the detection and measurement of ionizing radiation, and the biological effects of ionizing radiation. (M.H.R.)

4061 USNRDL-TR-193
Naval Radiological Defense Lab., San Francisco.
EFFECTS OF DONOR AND HOST LYMPHOID AND MYELOID TISSUE INJECTIONS IN LETHALLY X-IRRADIATED MICE TREATED WITH RAT BONE MARROW. G. W. Santos and L. J. Cole. Dec. 1, 1957. 30p. Project NM 006 015.04.

4062
PROTECTIVE EFFECT OF 2-MERCAPTOETHYLGUANIDINE ON BONE MARROW CELLS X-IRRADIATED IN VITRO. L. H. Smith (Oak Ridge National Lab., Tenn.). Expti. Cell Research 13, 627-30(1957) Dec.

Radiography

4063 AFOSR-TR-57-95
Ohio State Univ. Research Foundation, Columbus.
PRODUCTION OF CLINICAL ROENTGENOGRAMS BY MEANS OF COMPACT RADIOACTIVE X-RAY AND GAMMA-RAY SOURCES. Final Report. H. D. Spangenberg, Jr. and M. L. Pool. Oct. 1957. 35p. RF Project 610. Contract AF18(600)-1305. (AD-136752).

New and known radioactive isotopes were synthesized and investigated which emit x rays and/or low energy gamma rays suitable for roentgenographic visualization of the teeth and their supporting structures. Data on the following isotopes were collected: Ce^{144}, Eu^{155}, Sm^{145}, La^{137}, Dy^{157}, Dy^{159}, Yb^{169}, Gd^{161}, and Tb^{157}. The difficulties encountered in the preparation of any one of the above radioactive substances, in sufficiently pure form, make it impossible to designate any single activity as the ideal source for all types of low energy radiography. Ce^{144} and Sm^{145} have acceptable characteristics and their use has resulted in good quality radiographs. (auth)

Radiotherapy

4064 NP-tr-9
RADIOACTIVE YTTRIUM Y^{90} AS A SOURCE OF RADIATION FOR INTRAPERITONEAL AND INTRAPLEURAL APPLICATION. K. E. Scheer. Translated by F. Hudswell from Strahlentherapie 101, 283-8(1956). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 3320.

Tracer Applications

4065 AEC-tr-3088
CHANGES IN BONES INDUCED BY THE INTRODUCTION OF RADIOACTIVE STRONTIUM INTO RATS. L. A. Cherkassky. Translated from Voprosy onkologii 2, 275-84 (1956). 15p.

4066 NP-tr-4
SUPPLY OF RADIOACTIVE ISOTOPES TO THE PLANT BY WAY OF THE LEAVES. I. V. Gulyakin and E. V. Yudintseva. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 111, 709-12(1956). 8p.

4067
OCCURRENCE OF AN UNKNOWN RADIOACTIVE SUBSTANCE AFTER SHORT-TIME PHOTOSYNTHESIS IN $C^{14}O_2$. O. Kandler (Univ. of California, Berkeley). Arch. Biochem. Biophys. 73, 38-42(1958) Jan.

4068
UPTAKE OF RADIOACTIVE PHOSPHORUS IN EXPERIMENTAL TUMORS. II. EFFECT OF VASCULARITY ON RADIOACTIVE UPTAKE IN NEOPLASTIC, INFLAMMATORY, AND NORMAL OCULAR TISSUE. Charles I. Thomas, Mary Sue Bovington, Jack S. Krohmer, J. W. MacIntyre, and J. P. Storaasli (Western Reserve Univ. School of Medicine and Univ. Hospitals, Cleveland, Ohio). Cancer Research 17, 1091-7(1957) Dec.

CHEMISTRY

Refer also to abstract 4582.

4069 CCC-1024-TR-271
Callery Chemical Co., Penna.
REACTION OF POTASSIUM BOROHYDRIDE WITH BORON TRIFLUORIDE. R. K. Pearson, L. L. Lewis, and L. J. Edwards — P. M. Maginnity, ed. Dec. 4, 1957. 10p. Project ZIP. Contract NOa(s)-52-1024-c.

A study was made of the potassium borohydride–boron trifluoride reaction to determine the feasibility of replacing sodium borohydride with a more readily available borohydride in the sodium borohydride–boron trifluoride preparation of diborane. Although potassium borohydride is much less soluble than sodium borohydride in diethylene glycol dimethyl ether, a 91% yield of diborane was obtained in this reaction. A potassium borohydride-borane complex, analogous to $NaBH_4BH_3$, apparently either does not form or is too unstable to be a significant intermediate. (auth)

4070 CCC-1024-TR-272
Carnegie Inst. of Tech., Pittsburgh.
CATALYTIC PYROLYSIS OF DIBORANE. R. B. Beckmann — P. M. Maginnity, ed. Dec. 9, 1957. 21p. Project ZIP. For Callery Chemical Co. Contract NOa(s)-52-1024-c.

The feasibility of catalyzing a directed pyrolysis of diborane to higher boron hydrides, by means of commercially available catalysts, was investigated. The results indicate that the usual metal catalysts such as Ni, activated Al_2O_3, and Pt have some catalyzing properties. The data, unfortunately, are too meager to demonstrate whether or not this catalysis is directional for the desired liquid products. With the solid catalysts tested it was always found that solid degradation products eventually stopped the reaction. The runs made to determine whether or not gas phase catalysis might occur due to the presence of methyl radicals from organic methyl compounds were inconclusive, but generally the results appeared negative. (auth)

4071 CF-53-5-172(Rev.)
Oak Ridge National Lab., Tenn.
COST ESTIMATE CHECK LIST FOR A NEW PROJECT. W. G. Stockdale. Nov. 25, 1957. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

An itemized list for capital and operating cost is presented to be used as a guide in estimating costs for a new project. The availability of cost indices, to relate the value used from listed cost to a current basis, is included. (W.L.H.)

4072 LA-1649
Los Alamos Scientific Lab., N. Mex.
PHYSICAL PROPERTIES OF NICKEL CARBONYL. K. A. Walsh. Nov. 24, 1953. Decl. Jan. 13, 1958. 14p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

(Harvard Univ., Cambridge Mass. and U. S. Geological Survey, Washington). Am. Mineralogist 42, 905-8(1957) Nov.-Dec.

An attempt was made to synthesize the fully hydrated (8 to 12 H_2O) form of torbernite. Under the petrographic microscope the precipitate was found to be microcrystalline, with low birefringence and extinction visible on some of the grains. The d-spacings are analogous to the spacings of fully hydrated zeunerite and autunite and to less hydrated species of torbernite group. The zeunerite is the arsenate analogue of torbernite. Some specimens of green crystals identified as zeunerite from Weisser Hirsch mine, Schneeberg, Saxony were studied in comparison to artificial torbernite and materials from the Dexter mine, San Rafael Swell, Utah. The uranospherite is a secondary mineral formed with various arsenates in the oxidized zone of a vein (Weisser Hirsch mine near Scheeberg, Saxony) carrying uraninite, natural bismuth, and cobalt–nickel arsenides. The mineral is a hydroxide or hydrated oxide of bismuth and hexavalent uranium, its formula is uncertain. The specimen was studied as to optical properties. (R.V.J.)

4014

A NOTE ON PREFERRED ORIENTATIONS IN URANIUM AS DETERMINED BY DILATOMETRIC STUDIES. Steinar Aas (Joint Establishment for Nuclear Energy, Kjeller, Norway). Tidsskr. Kjemi, Bergvesen Met. 17, No. 5, 77-9 (1957).

Uranium metal has been reduced 80% in thickness by rolling. The thermal dilations of the finished plates have been determined and correlated with theoretical dilations, calculated by assuming various types and degrees of preferred orientations. The results confirm that a (010)—(110) double texture develops at rolling temperatures just below the recrystallization point. β-treatment does not give completely randomly oriented metal. Cross rolling changes the developed textures which are again dependent upon the exact rolling schedule. (auth)